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THE WORTHIES OF CUMBERLAND.

OPINIONS OF THE PRESS

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&c. &c. &c.

THE

WORTHIES OF CUMBERLAND.

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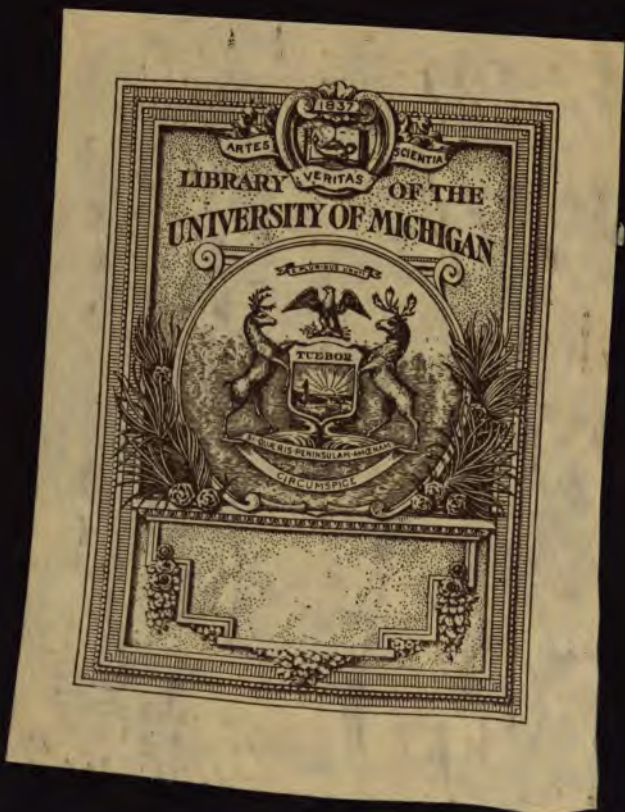
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To

SIR GEORGE B. AIRY, K.C.B.,

F.R.S., D.C.L., LL.D.,

Her Majesty's Astronomer-Royal;

One of the Eight Foreign Associates of the

French Academy of Sciences:

&c. &c. &c.

This Volume

is inscribed,

with the cordial good wishes and esteem of the

AUTHOR.

391064

PREFACE.

WHEN the first volume of the "Cumberland Worthies" was issued eight years ago, I hardly anticipated that my humble endeavours to portray the notable men and women of my native county would extend over six volumes, leaving me still in possession of materials for one or more publications. The conciseness of narrative that guided me in placing the biographies of two such public men as John Christian Curwen and William Blamire in one volume, has been kept in view throughout the series, my object being to present the main features in each person's history in a clear and intelligible form, and as free as possible from desultory and technical details. The memoirs of Sir James Graham and Dr John Dalton occupy the second and fifth volumes; the remaining four contain a mixed group of ladies, Cabinet Ministers, political economists, and not a few persons of meritorious position in art, literature, and science, whose lives illustrate such varied subjects as agriculture, anatomy, the fine and industrial arts, astronomy, botany, chemistry, geology, hydrography, mathematics, medicine, meteorology, poetry, and political history, &c.

The favourable reception which these volumes have met at the hands of learned critics, the pleasant acquaintanceships formed through their publication with men of distinction both at home and in our distant colonies, and the kind expressions of a large circle of friends whose good opinions I truly value, have afforded me much encouragement in the conscientious discharge of an arduous yet self-imposed task. An earnest wish to maintain the interests of the county, and to place the merits of its nobler citizens fairly before the English public, has been my chief aim and consideration. And although others might have done the work in a more acceptable style, I hope I may be pardoned for saying that none would have sought to do it more carefully and justly.

All writers are agreed in viewing biography as an arduous undertaking. In collecting the data upon which to found a narrative, you have to depend on various sources of information, and not less on the goodwill and abilities of your correspondents; then there is the sifting of evidence, and the reconciling of discrepant opinions, coming from sources alike credible and trustworthy; and a previous step in the inquiry involves the task of separating hearsays and traditional beliefs from the reliable facts of the case—all which demand no small amount of patience to clear up. A single instance may be offered from the present volume (and it is only one of many that might be cited in my own experience), to show how difficult it is to be assured of the accuracy of any statement till you subject it to a complete and searching test. The birthplace of George Graham

was assigned to three different farmsteads in Kirklinton Parish, and as it happened, all wrongly. The date of his birth was also a matter of doubt. To solve these apparently simple questions cost me a large amount of correspondence, much parochial inquiry, a consultation of the records of Westminster Abbey (and these, by the way, were not found altogether correct), an examination of the archives of the London Clockmakers' Company at Guildhall, and some bibliographical research in the "Bibliothéque Nationale" of Paris, as well as in the great public libraries of Britain.

The present volume contains thirteen memoirs, the subjects of which will be little known to the vast majority of Cumbrians; yet some of these worthies rank among the highest in inventive genius, and in the adaptation of mechanics to science, born to Cumberland, or known throughout England. Of George Graham and Edward Troughton it may be safely averred that they were incomparably the most eminent men in their own line in Europe.

Since the biography of George Graham was sent to press, I find that not only is the high praise therein bestowed on his labours as an astronomer fully borne out by Sir G. B. Airy, Mr Fletcher, M.P., and others, but that larger claim might have been made for his co-operation with the famous Dr Bradley in the discovery of the aberration of light and the nutation of the earth's axis; in other words, Graham would seem to have been a true partner in this great historical work, of which England is so justly proud. On considering the history of astronomy, the importance of Graham's improvements in horology rises more and

more strongly to view. In Flamsteed's time the art of horology was too backward to admit of the clock being used as a means of determining the fundamental right ascension of the fixed stars and other heavenly bodies, and consequently he was obliged to resort to an instrument of his own contrivance for determining this important element; but Graham's inventions placed the clock in the first rank as an astronomical instrument, and there is no probability that it will be ever superseded for the purpose of determining the element of right ascension. On a late visit to the Royal Observatory at Greenwich, I had the pleasure of seeing one of Graham's clocks, made one hundred and fifty years ago, still in use, and requiring no attention for upwards of twelve months.

I have much pleasure in offering my cordial thanks to Sir G. B. Airy, the most eminent of living astronomers, for his gracious and prompt response to all my inquiries regarding George Graham, for whose memory he entertains a high regard; to Mr Isaac Fletcher, M.P., for his hearty aid and encouragement at all times, and for his special interest in the lives of Graham, Troughton, and Miller; to Mr Henry Bell, surgeon, for his painstaking inquiries relative to the worthies of his native town of Cockermouth; to Mr William Jackson of Fleatham House, St Bees, for his usual liberality; to the Venerable Provost of Queen's College, and Mr T. W. Jackson, M.A., of Worcester College, Oxford; to Captain F. R. Sewell, of Brandlingill, Cockermouth, and others whose names appear in the text or footnotes of this volume.

Another volume seems requisite to complete the

series; its publication, however, cannot be promised, owing to my health requiring temporary, i not permanent, repose from literary work. Having travelled so far as the sixth milestone on the road with approving auditors, I do not like to bid them adieu when another stage might probably bring us to the end of our journey.

The work has been truly a labour of love. If ample leisure and industry were essential to the basis of the undertaking, the superstructure owes its characteristics to my innate love of Art, frequent travel in foreign lands, cordial communion with superior minds, and an early training in the pure and natural sciences. Although these memoirs fall far short of my biographical ideal, perhaps the efforts of several years to gather what light could be thrown on the lives of the more gifted sons of Cumberland, or tend to the elucidation of local history, may not be deemed inopportune or unacceptable to the present or future generations of my fellow-countymen. The sole reward of my endeavour is the heartfelt satisfaction of having rescued not a few benefactors of their age and race, and who, in times past, shed a lustre over the paths of industry and knowledge, from the shades of oblivion to which the majority of them were rapidly hastening. One should "not willingly let die" those who have played a prominent part in the constitutional, intellectual, and industrial advances of their times, but honestly endeavour to perpetuate their memory, not by sepulchral *immortelles* that fade and perish, but by offering faithful records of their lives and example to a thoughtful and reading public.

If these Worthies—many of whom have risen by their indomitable industry, inventive skill, and mental sagacity from the lower strata of social life to eminence in letters, and a proud position in the arts and sciences—be rightly studied by a virtuous generation, I trust I may entertain the hope, arising from a deeply-cherished regard for the historical reputation of my native county, that these volumes have not been penned to a vain or imperfect purpose.

ROSE HILL, CARLISLE,
April 23, 1875.

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GEORGE GRAHAM,

CLOCKMAKER.

"Action alone gives a man a life worth living; and therefore he must aim either at the practical application of his knowledge, or at the extension of the limits of science itself. For to extend the limits of science is really to work for the progress of humanity."—HELMHOLTZ.

AMONG the noble and illustrious dead of England, whose remains are entombed within the walls of Westminster Abbey, is laid the dust and all that perisheth of George Graham, the clockmaker.

Coveting neither dignities nor riches, and content through life with the designation of his trade calling, Graham can have been no ordinary artist to be deemed worthy of posthumous honours but rarely conceded even to the great and renowned of the land. He appears to have loved his art for its own sake, and the pleasure it afforded him in exercising his inventive genius on various instruments calculated to promote the progress of scientific observation. Inspired by a rare enthusiasm, he showed himself a faithful representative of the dignity of labour in the truest sense. His merits as a mechanic must have been

prominent and long sustained, and his personal character no less estimable, to have claimed so marked a recognition at the hands of his contemporaries, who willingly paid a tribute to his memory of high historical meaning. A man of consummate ability and worth, Graham was one of those rare types of Englishmen whose lives, being literally spent in their workshops, yield a harvest of benefits, no less available in ennobling the paths of industry than in promoting the resources of human happiness and a higher civilisation.

Though Cumberland has produced several men of high eminence, among whom may be noted a national poet, *Wordsworth;* a renowned physician, *Addison;* a noble sculptor, *Watson;* patriotic statesmen, *Curwen, Blamire,* and *Sir James Graham;* and one of the most original cultivators of science—*John Dalton*—ever born to England: none of her worthies, excepting George Graham, the clockmaker, have received interment within the hallowed ground of Westminster Abbey. And if no one of nobler mark than this brave son of industry had been born to the county, Cumberland would not be without her share of national honour in having presented to the world of art a man who contributed important services, not only to his own country, but to mankind in general.

George Graham sprang from the ranks of industry, and claimed affinity with the bucolic residents of a small hamlet verging on the border-land separating England from Scotland, a district that in his day bore no great repute for either honesty or well-meaning. History is silent, and tradition affords but little clue to his ancestral tree, beyond the surmise that its

roots were supported on a tenacious and not too fertile a soil. Whether farmers or handicraftsmen, there was nothing in the family status of the Grahams indicative of a tide that leadeth on to fortune, unless it were the possession of bodily activity, and an earnest endeavour on their part to catch the flood. Neither the locality of his birth, nor his own surname—Graham*—stood in good odour south of the river Irthing and the broader Eden, that in its course to the Solway Firth enhances the loveliness of Corby Walks, and lends no small colouring to the landscape around "merrie Carlisle."

It ought to be remarked, as the circumstances probably affected Graham's early departure from home, that whilst a general feeling of disquietude prevailed throughout Britain in the seventeenth century, political and social dissensions were specially rife in the Border counties. The union of the Crowns of England and Scotland under one head had been accomplished; but the legislative Parliaments north and south of the Tweed were often opposed, and there was no true union of the peoples. The reign of the Stuarts abrogated by the Parliament, and the Cromwellian Protectorate, and the many critical undercurrents in our foreign relations, implied instability of Government, and other changes affecting the political welfare of Britain. Proceeding from these vicissitudes in the policy of the State, some of which were harsh legacies of the Tudor dynasty, the religious beliefs of

* Those who are interested in the Border Græmes, and the marauding expeditions in which they were engaged, will find a brief history of their doings in my "Life of Sir James Graham," second volume of the "Worthies of Cumberland."

Englishmen were in a state of transition, and more frequently of doubt. The Catholics, the hybrid Churchmen of Henry the Eighth, the Presbyterians, and Independents, were more or less disposed to aim at supremacy. Cumberland not only had her share of all the denominations, but rejoiced to hear the powerfully influential voice of George Fox. Coming to the Parish of Kirklinton, in which the subject of this memoir was born, Fox offered a free gospel to, and obtained a large following of, the people, among whom the clans of Græmes, or Grahams, were not the least numerous.

Most of the brief biographical notices of George Graham, clockmaker, assign the year 1675 to his birth, and as generally associate Horsegills, in the Parish of Kirklinton, Cumberland, as the residence of his parents. The parish registers of Kirklinton afford no assurance, inasmuch as they do not include the period alluded to; the earliest records only going as far back as the year 1687, and but little care seems to have been bestowed upon the registration till the year 1706—a circumstance calculated to show that Episcopacy had but slender hold in Kirklinton two centuries ago.* Frustrated in my inquiry in this

* The illiterate and disquiet state of the country is sufficiently indicated by the circumstances given above. The few people who might be regardful of records marking their social position and domestic changes—*e.g.*, births, marriages, and deaths—had not always the benefit of a parson able to fulfil his duties. Nay, a century afterwards curates might have been found in country districts verifying Macaulay's insinuation that all the learning required of the said curates was a sufficient knowledge of arithmetic "to cast up the farrier's bills" for the Squire. The careless way in which some parish books was kept was owing to the sheer indifference of the clerk, who took for granted that the heads of families had their big Bible in which to make due records of births

direction, I was led to consult the registers of the Society of Friends in Cumberland, and there found the following entry among the list of births :—

Name.	*Birth.*	*Parents.*	*Abode.*
GRAHAM, GEORGE.	1673. 7. 20.	GEORGE.	RIGG.

As this record* did not sanction the ordinarily accepted opinion relative to the date and place of Graham's birth, further investigation to clear up the discrepancy became imperative. A writer in the "Biographie Universelle" had stated that Graham was born a Quaker, and this version of his religious origin was adopted by the "Encyclopædia Britannica;" not, it may be inferred, without some reasonable foundation. Now, considering the comparatively small number of Quakers in the general community, the very circumstance of his being so particularised affords presumptive evidence of the accuracy of the French authority.

All are agreed that Graham went to London in 1688, a memorable year in English history, when, if

and deaths. On the other hand, the majority of the rural population, steeped in ignorance, cared nothing for baptismal records, owing, in part, to the indiscriminate love-making then prevailing, and a healthy propagation of the species under circumstances that offered no great inducement to publicity. The legality of weddings was then as much established by the common consent of the contracting parties and their friends, as by sacerdotal ceremonies; whilst death, falling to every man's lot, gave to the relatives of the poor but one public anxiety, and that was a "decent burial"—the "lying tombstone" being reserved for the Squire and yeoman, upon which figured the hour-glass and cross-bones, and many bold letters proclaiming the virtues of the deceased.

* It is due to the Society of Friends, whose habits of order and discipline are worthy of all praise, to say that their registers for the seventeenth and eighteenth centuries show more accuracy than any other records of the kind to be met with in Britain.

he was born in 1675, he would be but thirteen years of age, and hardly up to the mark of a mechanic's servitude. If, however, the Quaker's registry be adopted, and the year 1673 as the date of his birth, he would be two years older, with bigger bone, and stronger sinews, and of the age generally fixed upon for commencing an apprenticeship. Happily for my conjectures as to Graham's birth occurring in 1673, the tombstone erected to his memory in Westminster Abbey Church records that he died in 1751, in the 78th year of his age, and this corroborative evidence would appear to settle the question. His being born at the "Rigg" offers no difficulty, as his parents may have removed from thence—a distance of two miles—to the Horsegills, the home associated in George Graham's memory.

Though born a Quaker, Graham left home at an early age, and may not have joined in the duties of full membership of that body; and if he had no strong opinions on the subject on reaching London, his earlier indoctrination may have given way to the prevailing religious sentiment of his new social circle. At any rate, there is no evidence of his partaking in the "concerns of Friends;" and, like many others, he may have quietly dropped the connection. He can hardly have been a Quaker in the full acceptation of the term, or his name would have been more familiar to the present age; for it must be acknowledged that a man of historical eminence in the Society of Friends, among whom written records and trustworthy traditions prevail, is not readily forgotten.

It may be stated *in limine*, that though bestowing

no small amount of pains in the inquiry, and ready to benefit by the traditionary statements in vogue in the Kirklinton district, I am not able to advance much information regarding the boyhood and family history of George Graham. The date of his birth, July 20, 1673, and the religious persuasion of his parents, may be viewed as determined; and it may be observed that the Quaker discipline of his early youth, marked by self-denial, steady habit, and correct speaking, would not be without its influence on a lad of precocious talents and thoughtful character.

Of Graham's position in London, his rare inventions and scientific researches, which constitute his real history, I hope to offer a tangible narrative collated chiefly from the "Transactions of the Royal Society, London," and the pages of contemporaneous history; and further exemplified by his successors engaged in the art or exposition of clockmaking, or in fashioning scientific instruments for astronomical purposes.

The only education available to George Graham would be got at the village school, and the instruction obtained there would be of a limited kind, embracing at the most reading, writing, and the rule of three. On removing to London, it may be inferred from his studious habits that he lost no opportunity of rectifying the deficiencies of his youthful education, by improving his knowledge on various subjects pertaining to his own work and the larger field of natural philosophy. Without a long and diligent self-education he could not have maintained his position among men of historical distinction and known ability. It is supposed that his father died when he was very young, and that his brother William, of Sikeside, act-

ing *in loco parentis*, favoured his going to London. Did the inducement of sending a boy of fifteen to the metropolis arise from his displaying a rare mechanical ingenuity, as tradition avers; or had he relatives or friends there ready to advance his interests? His family would not be likely to possess much worldly means, and in those days riches consisted in a contented mind, and the power to sustain life by healthy industry and honest purpose. In all well-conducted households there was the desire to save something to meet contingencies, and the Grahams being men of thrift, had no doubt some guineas stored up* to enable them to give their sons a humble start in the world.

A journey from the northern extremity of England to London two centuries ago was a bold undertaking for an inexperienced youth, who had to trudge it on foot from Kirklinton, a distance of 310 miles. Graham, it is true, sprang from the loins of a hardy race, keenly alive to their personal interests, and the enjoyment of independent action; and his whole life proved the possession of a north-country energy that is aye ready with a stout heart to meet a stiff brae. Nature had endowed him with an active brain, discerning eyes, and nimble fingers, and these were supported by a leal heart and robust frame—truly noble gifts in

* There were no banks accessible to country districts for more than a century and a half after the time spoken of in the text. The surplus earnings of industrious families, being converted into the more precious metals, were placed either in secret drawers, or wrapped in worn-out stockings, and cast to the bottom of some old chest or cabinet, among discarded habiliments, to allay suspicion. These were known practices; and to this day, in the outlying districts of Cumberland, people are eager to buy old cabinets or "kists," not only for their intrinsic value, but with the possible chance of finding in their secret arrangements notes or guineas to boot.

competitive life, and more than balancing all the privileges likely to arise from superiority of rank or hereditary wealth. Carrying his outfit on his back, and a few coins of the realm in his pouch, Graham passed onward through the Scottish gates of the Border City—gates of terrible omen to the northern foe and border reiver. The world lay before him, and the obvious thing for him to do was to make the best use of it. To have stayed by the domestic hearth, the tillage of moorland, and other kinds of clodhopping, would have been a sad waste of his mental capacity, and little less than a moral slavery to a man born to enrich the world with new ideas and practical inventions. What may have been the guiding thought of the raw bucolic lad bidding adieu to kith and kin, and the fells and dales of canny Cumberland, is not easy to divine; but no stretch of imagination could have approached the actual facts that transpired in his career—the Lord Mayoralty itself being but a bubble reputation compared with the historical part he was to play in the metropolis of England.

Two opinions have been repeatedly expressed regarding Graham's apprenticeship: the generally accepted one assigned his indentures to Mr Tompion. The doubts prevailing on this subject meet with a ready solution on appealing to the original records of the Company of Clockmakers, London, as the following excerpt, obtained through the kindness of Mr John James Hall, shows:—"At a Quarter Court holden the 2d day of July 1688 (Thomas Taylor, Master), George Graham put himself Apprentice unto Thomas Aske for seven years from this day." After the expiration of his term, the record runs:—"At a

Quarter Court holden on Monday the 30th September 1695, at 8 of the clock in the forenoon, at the George in Ironmonger Lane (William Clement, Master), George Graham, who was bound Apprentice unto Henry Aske, was admitted a free clockmaker." The reader will notice that Thomas and Henry Aske are both credited with being the master of Graham. The probability would have been in favour of Henry Aske, whose name occurs on Graham taking up his freedom; but the matter is set right by a statement in an old abstract form in the possession of the Company, satisfactorily proving that Henry Aske was Graham's master.

Graham being a free clockmaker, might well be eager to see the work passing through the hands of Mr Tompion, designated the "father of clockmaking," and on just grounds, seeing that he, in 1695, invented the cylinder escapement. He was also the first to construct the spiral pendulum-spring invented by Hooke—one being made for Charles II., bearing the inscription, "Robert Hooke *invenit*, 1658—Thomas Tompion *fecit*, 1675;" * and his name is also happily associated with the construction of repeating clocks for the inventor, Barlow, towards the end of that king's reign. Tompion was in the zenith of his fame, and required the services of high-class operatives, and in Graham he found a steady, trustworthy person, of great aptitude and foresight, and as earnest for the completeness of his work as his master could be for the character of his establishment. As there can be no greater bond between men than their harmonious co-

* *Horological Journal*, June 1872, p. 113, "Thomas Tompion, George Graham, and Westminster Abbey," by John James Hall.

operation in the performance of work demanding great pains and patience, the master and his journeyman suited admirably. Tompion, who could not help liking the Cumbrian of so many good qualities of head and heart, invited him to his house, and bid him welcome to his social circle. This pleasant friendship received no check till Tompion paid his debt to nature in 1713. Both men were masters of their handicraft, and both obtained historical position inferior to none of their predecessors engaged in horological pursuits. Tompion devoted himself mainly to clock and watch making. Graham, prompted by a higher genius, sought other walks for the manifestation of his skill, and lived to aid in no small degree the sciences collaterally dependent for their evidence on finely-adjusted apparatus. The master passed away, ripe in years and renown; and the faithful assistant, growing in experience and excellence, produced a higher workmanship, that obtained a world-wide fame as lasting as history itself. As these two artists lived from day to day, and for many years, in amity and brotherly love, their surviving friends deemed it well not to separate them in death; so the grave that closed over Thomas Tompion in 1713, was reopened in 1751 for the reception of the body of George Graham.

There seems no clue to the date of Graham's commencing a shop of his own at the sign of the Dial and one Crown, opposite the Bolt and Tun, in Fleet Street, where he obtained a large and lucrative business, not only in clocks and watches, but as a mathematical instrument maker. His house was above the shop, and from its upper story he made numerous astronomical observations.

Bearing on his trade interests, and so far reflective of his social affinities, it may be remarked in this place, that all along he manifested a strong wish to promote the success of his own fraternity or corporation. These excellent motives did not escape the attention of the chief members of his Guild. Thus, in April 1716, he was elected "Assistant of the Court" of the Company of Clockmakers of the City of London. On October 26, 1720, he was sworn "Renter Warden;" and on October 19, 1721, was raised to the position of "Upper Warden." On September 24, 1722, three members were put in nomination for the office, and George Graham was chosen "Master"—the highest honour the Court had to bestow.

The mantle of Thomas Tompion seems to have fallen upon the shoulders of George Graham, and with happy result to the progress of art. Graham's known proficiency in work, and the proofs he evinced of his eagerness to keep abreast of the times, and of every new device pertaining to his own calling, and not less to extend the lines of physical science, could not fail to attract the attention of the curious and learned. His generous and upright dealings, and his affable manners and conversation, conjoined with a high moral and intellectual standard, tended also to enhance his reputation as a London citizen. His shop was much resorted to by men of science seeking mechanical apparatus to enable them to elucidate the phenomena of general physics, and, fortunately for him, the times were opportune for the recognition of his services.

From the dawn of the eighteenth century there was a growing tendency to the study of natural philo-

sophy, owing in part to the spread of knowledge, and still more to the formation in the year 1662 of the Royal Society, whose meritorious chiefs, *e.g.*, Sir Isaac Newton, the Hon. Robert Boyle, Hooke, &c., afforded exemplary encouragement to the rising men of science who figured in what has been termed the Augustan era of England. The indoctrination of science was also felt on the Continent, but none aided more in its new development than a few leading observers congregated around St Paul's, London. Graham shared in the fresh impulse, and helped to give it a wholesome direction by ingenious inventions, and not less by experimental investigations of his own, conducted in the true spirit of the inductive philosophy. His manipulative skill, originality of design and scientific ardour, at length came under the favourable notice of several distinguished members of the Royal Society, who proved their sagacity by enlisting him to their highly-prized ranks.

George Graham was elected into the Royal Society on March 9, 1720, and admitted March 16, 1720. His merits early attracted the attention of that learned body, and he was elected to the Council at every alternate anniversary from the year 1722 to the year 1746.* He proved himself worthy of the honours conferred upon him by contributing twenty-one papers to the "Philosophical Transactions."

To open the doors of the highest guild of science in Britain to a Fleet Street clockmaker may at first sight appear no less strange than incongruous, yet further consideration will show that the Royal

* For these dates I am indebted to the kindness of Mr Walter White of the Royal Society.

Society acted in an appropriate and praiseworthy manner by admitting to their councils a master-workman to whom work was not simply a profession but a daily vocation. If the art practised by Graham was only in its initiative stage; there were minds in the Society fully alive to the significance of every tentative effort that would facilitate the correct measurement of time, or aid in the solution of the deep problems of astronomy. And whoever could fashion the more delicate instruments by which satisfactorily to promote these great objects affecting science, and not less the common interests of mankind, justly claimed the recognition of a true artist, on a par with the astronomer himself. Scientific observations can only be made through certain media, the arrangement of which rests with the mechanician; so that art and science are mutually dependent on each other. In offering the right hand of fellowship to Graham, the Society did not look upon him as a clockmaker simply, but as a man whose skill and aptitude brought to light the best means of rendering the measurement of time and the scrutiny of the heavens worthy of confidence.

The honour bestowed on Graham at once admitted him a citizen of the republic of science, and exalted him to a position that he well merited and equally well adorned; nor was it less gratifying in proving that the decision of the Royal Society was guided by a true magnanimity and clear comprehension of the progressive character of the times. Art, in its finer industrial forms, was being pushed forward by men like Graham, and viewed by the public as a reality indicative of the impressive

and ennobling; and not unworthy of the estimation in which it was held in the glorious days of Greece and Rome; or during the glimmering light that now and then sprang forth from the chaos of mediævalism. Who, it may be asked, were the men who adorned the Acropolis of Athens with an indescribable magnificence of art? Who filled the Roman Forum with edifices the very ruins of which tend to revivify the historic period of the Republic? Who erected the Byzantine and Lombard works, and the ecclesiastical buildings of twelfth-century England? Not connoisseurs in art—not mere architects or draughtsmen, but master-workmen of trained experience, whose hands could carry out the inspirations of the æsthetic mind, rejoicing in offering works of lasting grandeur as a willing homage to the deity. The workmen in those days were not ashamed of their tools or the instruments of their labour; they were only put to the blush by the discovery of flaws* in their workmanship

* In the eighteenth volume of the "Biographie Universelle" is an article on Graham written by M. Lefebvre-Cauchy, containing the following anecdote, that shows the degree of precision which Graham sought for his own workmanship. It may be premised that the extreme accuracy implied by the narrator is inconsistent with all experience of the time-keeping power of the best watches. "A gentleman who had ordered a watch, told Graham, when the watch was delivered to him, that he was going off to India for about seven years, and that he wanted to know how far he might rely on the regularity of the movement. 'Sir,' replied Graham, 'it is a watch which I have made and regulated myself; take it with you wherever you please. If after seven years you come back to see me, and can tell me there has been a difference of five minutes, I will return you your money.'

"After a lapse of more than seven years, the gentleman returned, and, with a serious countenance, said to Graham, 'Sir, I bring you back your watch.' 'I remember our conditions,' said Graham; 'let me see the watch. Well, what do you complain of?' 'Why, I have had it

that they sought to make perfect. Michael Angelo declared himself a "carver," and achieved a world-wide repute; George Graham, though filling a less significant but not less useful place in history, desired no other appellation than that of clockmaker, and by trusting to the cunning of his own hands reaped the fame honourably due to a long life of labour and self-devotion to his artisanship.

HOROLOGY.

For every fundamental astronomical observation without exception, the first requisite element is accurate time. Now the science that has for its object the measurement of time has engaged the foremost minds of every age. Observations of the heavenly bodies; the shadow of an upright object suggesting the invention of sun-dials; water and

seven years, and there is a difference of more than five minutes.' 'Indeed! in that case, sir, I return you your money.' 'What do you mean?' 'I mean to fulfil my engagement.' 'Are you in earnest?' 'Never otherwise.' 'I would not part with my watch for ten times the sum I paid for it.' 'And,' replied Graham, 'I would not break my word for any consideration. A promise is sacred. I promised, on certain conditions, to take back the watch. In consequence of that promise you have returned it to me, and no power on earth shall force me to violate my engagement.' Graham was true to his word, and to his last day he used the watch as his regulator."

There was no sham-and-shoddy work sent out of the shops of Tompion and Graham. Prior, in his "Essay on Learning," says that so jealous was Tompion of his reputation as a watchmaker, that he would not allow his name to appear on any of his work which was not the best of its kind. It is related that on the occasion of a person applying to him on the subject of a watch upon which his name had fraudulently appeared, he at once broke it with a hammer, and presented another to the person, saying, "Sir, here is a watch of my making."

sand clocks; or the clepsydra, and the hour-glass, were the primitive modes of noting the fleeting hours. These methods being found insufficient, pieces of mechanism were contrived, which were kept in motion either by the action of gravity, through the medium of a weight, or by the elastic force of a spring; these mechanisms were named timepieces, clocks, &c.

The history of clockmaking is involved in the obscurity that marks the events of the darker ages of European life. Italy, ever in the van of discovery, had her horological contrivances and striking clocks as early as the thirteenth century, if not at an anterior date. England had apparently come to a knowledge of the Italian work, as, in the year 1288, a fine was imposed on the Chief Justice of the King's Bench, and applied to the purpose of furnishing a clock for a clock-house near Westminster Hall; and, according to Admiral Smyth, a clock is still in existence at Dover Castle bearing date 1348. Perhaps the most noted clock was the one constructed by Henry de Wyck, that graced the tower of the palace of Charles the Fifth of France five centuries ago.

Clocks of a certain kind were introduced into England during the sixteenth century, chiefly of German or Augsburgh manufacture, and not possessing high merit. Thus Shakespeare, in "Love's Labours Lost," makes Biron says that a woman was

> "Like a German clock,
> Still a repairing, ever out of frame,
> And never going aright."

And as if clocks were little known, or little trusted

in the rural districts, Shakespeare in the same play makes Spring sing—

> "When shepherd's pipe on oaten straws,
> And merry larks are ploughman's clocks."

Drayton indicates the same bucolic condition as that described by the great bard, and his words—

> "The cock, the country horologe, that rings
> The cheerful warning to the sun's awake,"—

would have been found quite applicable to a century later than the date of his verse.

The illustrious Tycho Brahe, in 1560, is said to have possessed four clocks marking seconds as well as minutes; but neither he nor Moestlin, his contemporary, seem to have attained that great desideratum —a measured accuracy of time.

With the institution of a mainspring for a weight, portable clocks came into use, and they marked a second era in horology.

The observations of the renowned Galileo pertaining to this inquiry were of two classes. First, that the same lamp swung in the same time, whether its vibrations were short or long. Secondly, that different lamps swung in times proportional to the square roots of the lengths of the cords by which they were suspended. These data led to the development, in the hands of Huyghens and Harris, of the pendulum clock—the third era in the art of clockmaking. Now a host of competitors appeared in the field, including the chief mechanicians in Europe, those of England being not the least active in the race of competition.

A greater era in the history of clock and watchmaking commenced early in the eighteenth century, when George Graham appeared as an original inven-

tor, and one of the most distinguished men of his time. He enriched the century by three important inventions in horology—namely, the *Mercurial Compensating Pendulum;* the *Dead-beat Escapement* for clocks, and the *Horizontal* or *Cylinder Escapement* for watches.

Whether the pendulum or the escapements first engaged his thoughts is not very clearly established; but as no one ever questioned his claims to the three discoveries, the preliminary steps to which may have passed under review about the same time, the historical sequence may be deemed of less moment. As he attached considerable import to the discovery of the mercurial pendulum, its consideration may take precedence in this narrative.

Without entering upon the general history of the pendulum, in which the noble Galileo and Tycho Brahe, and many ingenious artists, played a part, it may be briefly stated that to the celebrated Dutchman, Christian Huyghens, Dr Robert Hooke, the Gresham professor, and William Clement, the famous clockmaker, the greatest credit is due. If Huyghens claimed larger scientific acumen, of which such clear proof is afforded in his mathematico-mechanical work the *horologium oscillatorium*, the "royal pendulum," the anchor pallets, as well as the invention of the spring balance, belong to Hooke, who brought the *crutch* or *anchor* escapement before the notice of the Royal Society as early as 1666, though it was 1680 before Clement practically introduced it into the art of clockmaking; Clement also had a share in making the royal pendulum.*

* The anchor escapement introduced the practice of suspending the

The chief defect now remaining in the pendulum was its liability to change its length, and, consequently, its time of vibration with every change of temperature to which it might be exposed. This defect at once presented itself to Graham's reflective mind, and about the year 1715 he tried several methods of correcting this fault by watching the difference of expansion between brass, steel, iron, &c., when exposed to the same degree of heat. These experiments point very distinctly to the gridiron principle,—a principle that he was the first to establish in 1715,* but as they did not satisfy him, he turned his thoughts in another direction, and with better success. The results of his observations he communicated to the Royal Society in 1726, in an essay entitled "A Contrivance to avoid the Irregularities in a Clock's Motion occasioned by the Action of Heat and Cold upon the Rod of the Pendulum." His description will be best understood in his own words, given in the Abridgment, vol. vi. part i. p. 297, of the "Philosophical Transactions":—

"Whereas several, who have been curious in measuring of time, have taken notice that the vibrations of a pendulum are slower in summer than in winter, and have very justly supposed this alteration has proceeded from a change of length in the pendulum itself, by the influences of heat and cold upon it, in the different seasons of the year; with a view, therefore, of

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pendulum by a thin and flexible spring; and the seconds pendulum with this escapement was called the royal pendulum.

* It is worthy of note, that the gridiron pendulum conceived by Graham, and abandoned by him in 1715 in favour of the mercurial one, was taken up in 1726 by the famous John Harrison, born near Pontefract, Yorkshire, though spoken of at times as a Lincolnshire carpenter, and carried to a successful issue. His name appears in a subsequent page of this Memoir.

correcting, in some degree, this defect of the pendulum, I made several trials, about the year 1715, to discover whether there was any considerable difference of expansion between brass, steel, iron, copper, silver, &c., when exposed to the same degree of heat, as nearly as I could determine, conceiving it would not be very difficult, by making use of two sorts of metals, differing considerably in their degrees of expansion and contraction, to remedy, in great measure, the irregularities to which common pendulums are subject. But although it is easily discoverable that all these metals suffer a sensible alteration of their dimensions by heat and cold; yet I found their differences, in quantity from one another, were so small, as gave me no hopes of succeeding this way, and made me leave off prosecuting this affair any further at that time. In the beginning of December 1721, having occasion for an exact level, besides other materials I made trial of, quicksilver was one; which, although I found it was by no means proper for a level, yet the extraordinary degree of expansion that I observed in it when placed near the fire, beyond what I had conceived to be in so dense a fluid, immediately suggested to me the use that might be made of it by applying it to a pendulum. In a few days after I made the experiment, but with much too long a column of quicksilver, the clock going slower with an increase of cold, contrary to the common pendulum; however, it was a great confirmation of the advantage to be expected from it, since it was easy to shorten the column in any degree required. The only doubt I entertained was lest there should not be a proportional expansion and contraction between the quicksilver and the rod of the pendulum, through the various degrees of heat and cold, from the one extreme to the other. To make this experiment the more convincing, I placed a clock in a part of the house the most exposed of any to the changes of heat and cold, the room having no fire in it in the winter, and exposed to a south sun, with leads above it, which, in the summer, made it extremely hot. I hung a thermometer by it, and had likewise another clock at no greater distance from it than was necessary to keep the cases from touching one another. This clock had been made some years before with extraordinary care, having a pendulum about sixty pounds in weight, and not

vibrating above one degree and a half from the perpendicular, and which, in a more temperate situation, had not altered above 12 or 14″ in 24 hours, between winter and summer; but in this place it altered 30″ a day, between the hottest and coldest weather in the year 1722, a year no way remarkable for either extreme. But this great alteration was owing to the situation I mentioned above, and which I made choice of for the sake of making the experiment the more sensible. The two clocks being firmly screwed to a party-wall, I began to make the first trial of this kind of pendulum, December 18, 1721, and by January 3, [1722], perceiving the pillar of quicksilver considerably too long, I procured a shorter glass, which I got ready by the 8th, and made use of until the beginning of June following, by which time I was well satisfied of the advantage of the contrivance, notwithstanding both these pendulums were but rudely executed, and this last had the pillar of quicksilver too short, but much nearer the true length than the first. This encouraged me to provide another glass a little longer than the last, and to bestow more care upon all the parts of the pendulum that required exactness. This being finished by the 9th of June, I began then to observe the motion of the clock by the transits of the fixed stars, as often as the weather permitted, making use of a telescope which moved in the plane of the meridian; with this instrument I could be sure of not erring above two seconds in time. The clock was kept constantly going, without having either the hands or the pendulum altered, from the 9th of June 1722, to the 14th of October 1725, being three years and four months.

"For the first year I wrote down every day the difference between the two clocks, with the height of the thermometer, not omitting the transits of the stars as often as it was clear. The result of all the observations was this, that the irregularity of the clock with the quicksilver pendulum, compared with the transits of the stars, exceeded not, when greatest, a sixth part of that of the other clock with the common pendulum; but for the greatest part of the year, not above an eighth or ninth part; and even this quantity would have been lessened had the pillar of mercury been a little shorter; for it differed a little the contrary way from the other clock, going faster with heat and

slower with cold; but I made no alteration in length, to avoid an interruption of the observations. To confirm this experiment the more, about the beginning of July 1723, I took off the heavy pendulum from the other clock, and made another with quicksilver, but with this difference, that instead of a glass tube, I made use of brass, and varnished the inside to secure it from being injured by the mercury. This pendulum I have made use of ever since, and find it about the same degree of exactness as the other. The reason why this kind of pendulum is more exact than the common sort, will be evident to any one who considers that as heat lengthens the rod of the pendulum, at the same time it increases the length of the pillar of quicksilver, and its centre of gravity is moved upwards; and when by cold the rod of the pendulum is shortened, the pillar of quicksilver is likewise shortened, and its centre of gravity carried downwards. By this means, if the column of quicksilver be of a proper length, the distance between the point of suspension and the centre of oscillation of the pendulum will be always nearly the same, upon which the exact motion of a clock principally depends. Were the pendulum of a clock to remain invariably of the same length, yet some little inequalities would appear in its motion, from the difference of friction arising from the imperfections of the materials, as well as different degrees of foulness; upon which account the force communicated to the pendulum would not be constantly equal, which would cause some small alteration. But when the pendulum is very heavy, and vibrates in a small arch, and the workmanship of all the parts is well performed, there will be very little inequality in the motion besides what proceeds from heat and cold.

"In making use of quicksilver for a pendulum, by varying the diameter of the vessel that contains it, or the thickness of the rod of the pendulum, whether it be of brass or steel, they may be reduced nearly to an equality as to the receiving or retaining the impressions of heat or cold, upon which the greater regularity of the motion depends; and particular care ought to be used to free the mercury from all blebs of air, otherwise their great and sudden expansion or contraction may cause a considerable disorder; but the air may as easily be excluded in this way as in a barometer, and the great specific gravity

of quicksilver renders it a proper material for the weight of a pendulum."

The highest praise has been bestowed on Graham's mercurial compensating pendulum, which, as Sir Edmund Beckett writes, "has long been almost invariably adopted as the best for astronomical clocks." In the same letter he says, "Troughton's tubular pendulum is now considered at Greenwich equal to the mercurial, since the improvement in the manufacture of zinc tubes. A zinc-and-iron pendulum, with a leaden bob, is of course much cheaper than a mercurial one of considerable weight; and it has been ascertained that the Westminster pendulum of that construction, weighing nearly 700 lbs., has no discoverable error of temperature."

The value of Graham's discovery of the dead-beat escapement will be best understood from a terse description of the various clock escapements by the Rev. W. Pearson, LL.D., F.R.S. ("Introduction to Practical Astronomy," vol. ii., p. 304. London: Longmans. 1829), under the heading "On the Transit Clock." Dr Pearson writes:—"Escapements may be divided into five classes—*recoil, dead-beat, isochronal, free*, and *remontoir*. The first of these, and which is most commonly applied to ordinary clocks, impels and retards by turns the alternate motions of the pallets by its continued action on their faces, occasioned by a force derived through the media of the wheels and pinions from a suspended weight denominated the maintaining-power; while the crutch, on the axis of the pallets, transmits this modified force to the rod of the pendulum, and thus perpetuates the vibrations. The constancy of the escapement-wheel's

action with the pallets in this construction, owing to their cuneiform shape, is so circumstanced that the force of the returning pendulum makes each pallet in its turn oppose the force derived from the maintaining power, when the wheel is obliged to recede for a moment, and the seconds' hand inserted on its axis at the same time recoils. The effect of this action is such alternate pushing and opposing of the pendulum in different parts of each vibration, that an increase in the maintaining-power accelerates the rate of going; and consequently any irregularity in the action of the wheel-work, which deals the force out in small portions, or any foulness from dirt or thickened oil, will have an undue influence on the rate by varying the arc of vibration, and accordingly this escapement is never adopted in an astronomical clock."

"To avoid the bad effect of a recoil, the justly celebrated Graham invented that species of escapement which is called *dead-beat*, in which the faces of the pallets are circular as well as concentric, and allow the teeth of the escapement-wheel to rest on them, while the pendulum is completing its vibration, after having received its impulse; this wheel, therefore, never recedes, and the hand carried by it remains motionless or dead for a certain portion of each vibration. The rubbing of the teeth against the circular portion of the pallet, however, produces some friction that requires a little fine oil to lubricate the parts of action, and an addition given to the maintaining-power by increasing this friction retards the rate of going. Hence the wheel-work is usually made with the greatest care, and pinions, of not fewer than eight or ten leaves each, are nicely fitted,

hardened, and polished to diminish the irregularities of transmitted force; the pivot-holes also of the two last wheel's arbors, as well as the pallets themselves, are frequently jewelled in the best clocks, to avoid friction as much as possible, and to supersede the necessity of applying much oil. Escapements of this description have long been held in high estimation where they have had the advantage of being united with a well-compensated pendulum. Indeed, till within these few years no other escapement was put in competition with it, and the observations made in the different public observatories for half a century back bear testimony to its competency. The circumstance of its giving the impulse to the pendulum at or near the lowest point of its arc when its momentum is a maximum, affords it a most important advantage."

The dead-beat escapement of Graham at once claimed approval, and continues in general use in regulators and astronomical clocks to this day. The French mechanicians viewed it as by far the best. After Graham's death, however, and probably about the year 1753, Lepaute, an ingenious Parisian, tried to improve upon Graham's mode, and for a time English clockmakers were divided in opinion as to the merits of the *recoil* and *dead-beat* escapements. For a time only, as with the passing away of the prejudiced partisans of the *recoil* escapement, Graham's invention came to be generally acknowledged at home and abroad as by far the best, but naturally, like other mechanical contrivances, capable of being further improved.

One fault found with Graham's dead-beat escapement was the length of the arms of the pallets, which

Thomas Grignion tried to obviate; on the other hand, it is supposed by practical clockmakers that Graham's reason for such long arms to his pallets was to show the superiority of his escapement over that of the recoiling one by the use of very heavy pendulums moved by a light weight. Many of his regulators went a month, and even to these he put heavy pendulums.

Graham left no written description of his *dead-beat* escapement, which implied but little regard for the historical fame attached to his inventions; yet this escapement holds its own after being subjected to the full trial of one hundred and fifty years. When Mr B. L. Vulliamy wrote on the Theory of the Dead-beat Escapement (*Quarterly Journal of Science, Literature, and the Arts*, vol. xvi. pp. 1, 2, October 1823), he was obliged to the works of French authors for his knowledge of the principle of Graham's escapement.

The latest authority on horology,* Sir Edmund Beckett, writes:—"Graham's dead escapement has been used for more than a century in nearly every astronomical clock in the world, and without it, it is hardly too much to say that there would have been no better time-keeping than could be obtained from a common kitchen clock made more carefully than usual; at least until some of the latter inventions of Hardy and others, which might have been more generally adopted if Graham's had not existed. It has also been nearly as much used in all public clocks, in which accuracy of time-keeping was aimed

* The reader wishing for a knowledge of this subject should consult "Rudimentary Treatise on Clocks, Watches, and Bells," by Sir Edmund Beckett, Bart. Sixth Edition, (London: Lockwood & Co.)

at, until it began to be superseded by Denison's (now Sir Edmund Beckett's) gravity escapement, which enables the great Westminster and other clocks to keep time within a second a week on the average. The single defect of Graham's escapement is that it requires uniformity of force and friction in the train, and the escapement to be kept clean, and, consequently, careful and expensive work. And with these conditions it must be admitted now to be inferior to several forms of the detached escapement, one of which is a kind of modification of Graham's by Sir G. B. Airy, the Astronomer-Royal, and is used in the standard clock at Greenwich." There is not, however, much in common to Graham's escapement and Sir G. B. Airy's, what little there is being the action of a wheel-tooth on a sloping pallet. The differences are, that in Sir G. B. Airy's there is no rubbing of the teeth against the circular portion of the pallet;* that the pendulum is untouched during the larger part (probably nine-tenths or more) of its swing; and that it is urged only once in the double vibration.

I am informed by the Astronomer-Royal, that three of Graham's clocks, with escapement untouched, are still at the Royal Observatory, perfectly efficient and good. One of them is at this time (Nov. 1874) detached on the service of the Transit of Venus to Rodriguez Island—a fact that speaks volumes for Graham's workmanship executed upwards of a hundred and fifty years ago.

About the end of the year 1695, when Mr Tompion made his watch escapement, and flattered himself on

* This will be better understood by referring to Dr Pearson's description of Graham's *dead beat* escapement in page 25 of this memoir.

its being an improvement, Graham became engaged as his journeyman. The new escapement seems to have drawn Graham's thoughts in the same direction, and in the course of time he announced his invention of the *horizontal* or *cylinder escapement* for watches, which escapement is held to be identical with his dead escapement for clocks, though the lever escapement resembles it more in appearance. The acknowledged superiority of Graham's escapement procured for his watches a considerable reputation for many years, both in his own country and in France, where they were introduced in the year 1728 by the circumstance of Julien le Roy having commissioned one from Graham. The introduction of the duplex escapement gradually tended to lessen the popularity of Graham's watches, possibly affected also by the excellence of Hull's workmanship as a cylinder escapement maker in London. Abroad, however, Graham's invention held its own against all competition ; and to this day it is curious to note that the horizontal escapement is used in nearly all the foreign watches, whilst the lever, which is only the application of the dead-beat escapement to a watch, is most generally in use in England. And this (the lever), believed to have been originally a French invention, was brought to its present state of improvement by Thomas Mudge, Graham's apprentice and successor.

These three great inventions of Graham's—the *mercurial compensating pendulum*, the *dead escapement*, and *horizontal* or *cylinder escapement*, have met with unqualified praise on both sides of the Channel. Among the recently expressed and trustworthy opinions, let me again cite from a letter addressed to

my friend Isaac Fletcher, M.P., by Sir Edmund Beckett, who writes:—"Looking at these inventions as a whole, it may be fairly said that they have had a greater success and influence in horology than those of any other man; though it may also be true that Harrison, the Lincolnshire carpenter, displayed more original genius, and made more important steps to improvement by his invention of the first contrivances for compensation of temperature, both in clocks and watches; and of the first chronometers, which satisfied the conditions laid down for the Parliamentary reward of £20,000, offered for one which would keep time within certain limits.* But none of Harrison's inventions had that amount of perfection which enabled them to obtain the perpetuity of Graham's. The chronometer, the most important of all horological instruments, because it has to depend for the longest time upon itself, uncorrected by the stars, sometimes for many months together, is an entirely different machine from Harrison's, and owes its present excellence to Earnshaw more than any one."

* John Harrison, already spoken of in page 20 of this memoir, was an exceedingly clever mechanic, who repaired to London in the year 1728, carrying with him diagrams of a machine for determining the longitude at sea, in the hope of being engaged to make one for the Board of Longitude. He submitted his plans to Graham, who, in a spirit devoid of all jealousy and rivalry, discussed them with the author, not only offering valuable hints, but suggesting, according to Dr Pearson (article "Clock," Rees' Cyclopædia), the use of metals as compensation; and this, it ought to be borne in mind, after he himself had invented the mercurial compensating pendulum. Harrison went home to mature what he had gathered from Graham, and possibly others, and seven years afterwards returned to London with his new chronometer, which, meeting with the approval of Halley and Graham, claimed the notice of the Government, and eventually obtained him the reward mentioned in the text.

The history of watchmaking in the seventeenth and part of the eighteenth century, proves that the art was nowhere more zealously cultivated than in London, where such men as Tompion and Graham solved many difficulties affecting the progress of their handicraft. Graham's services were held in very high esteem in Paris, the Hague, and chief cities of the Continent;* and every foreigner who had established an improvement in watchmaking repaired to London, in the hope of seeing his work fairly tested by Graham and other practical men. Thus, when Faccio the Genevan, who discovered the art of piercing holes in rubies, or any hard precious stone, found the Court at Versailles and the watchmakers of Paris insensible to his claims, he sought the inspection of English authorities, and obtained the reward due to his invention by being elected a Fellow of the Royal Society, a circumstance that led him and his partners, the two Debaufres, to establish a great business in watch-jewelling, in London.

* In a short biographical sketch of Maupertuis, in vol. iv. of "Index to the Memoirs of the French Academy," mention is made of the capture and pillage of this famous academician by Austrian hussars at the battle of Mollwitz in 1741. Being taken prisoner to Vienna, the Grand Duke of Tuscany, afterwards Emperor, pleased to see a man of such reputation as Maupertuis, treated him very kindly, and inquired if the hussars had robbed him of anything of real value. Maupertuis then acknowledged his great regret on losing *une montre de Graham, célebre horologer Anglais, l'Empereur qui en avoit une du même artiste, mais enrichie de diamans, la lui donna, en disant; c'est une plaisanterie que les hussars ont voulez-vous faire, ils m'ont rapporté votre montre; et je vous la rends.* M. de Maupertuis was one of the five persons deputed by the French Academy, in 1736, to measure an arc of the meridian in Lapland. The deputation was afterwards joined by the Swedish astronomer Celsius, who brought with him from London instruments made by Graham, of a very superior construction to any then in use.

The introduction of springs in place of bells in "repeaters," led Graham to adopt Julien le Roy's method in his watches, with this difference, however, that the repeating motion of Le Roy was what is called *plain*, whilst that of Graham's was the *Stockten* motion—a very ingenious contrivance of a workman of Graham's of the name of Stockten.

A moment's consideration of the foregoing sketch of watchmaking, in the history of which Graham played so important a part, will enable the reader to understand why London obtained such pre-eminence in the art, that all the world resorted to England for the best made watches. To help to break down this apparent monopoly, some dishonest foreign traders tried to pass off their comparatively worthless wares by engraving such English names as Graham's and Harrison's upon their workmanship. Of the surpassing reputation of Graham's watches on both sides of the Channel there can be no doubt; and in London he was styled the fashionable watchmaker. This is well brought out in the *London Magazine* for 1753, which gives an account of the ingredients required in the manufacture of a fop—"*Monsieur à la mode.*" One was—

> "A repeater by Graham, which the hours reveals,
> Almost overbalanc'd with knick-knacks and seals."

Mr Wood has collected a great amount of historical information regarding watches of all kinds, home and foreign; and from his data, it appears that Graham, in addition to his good workmanship in the interior, practised a large amount of adornment on the exterior of his watches. Thus for Lord Chesham he made a "watch with an oriental agate case, set round in

front with sparks of diamonds, mounted in gold;" also a good "double-case repeater watch, pierced and chased in relief with Orpheus and animals;" another "gold double-case watch, chased in relief with the offering of the Magi." In short, Graham was at the head of his art in London, where that art flourished most of all in the eighteenth century, and found customers, not only in the ranks of the rich and the aristocracy of England, but in every crowned head of Europe. He evidently dealt in first-class workmanship, and had he lived till 1787, might have confirmed the lines in Colman's opera, as far as they pertain to repeaters—

> "Complaisance is a gingerbread creature,
> Us'd for show, like a watch, by each spark;
> But truth is a golden repeater,
> That sets a man right in the dark."

In the few biographical notices to be met with of Graham, one finds reference made to a celebrated orrery of his construction, which appears to have been the prototype for all succeeding orreries. Thus Thomas Reid* of Edinburgh states:—"The first planetary machine or orrery made in this country was by the celebrated George Graham, clockmaker, who was well skilled in the various branches of speculative and practical philosophy."

The famous Dr Bradley, Astronomer-Royal, in the year 1734 communicated a paper to the Royal Society on the vibrations of the pendulum in different latitudes, and on the figure of the earth which might be deduced from them. This dissertation was based

* "Treatise on Clock and Watchmaking," p. 49,—a highly practical work, published in 1826, in one volume.

on information derived from the rates of going of an astronomical clock made by Graham for an observatory established by Colin Campbell, F.R.S., at Black River in Jamaica, lat. 18° north. It was known that pendulums of the same length do not perform their vibrations in equal time in different latitudes; and though experiments had been instituted in different parts of the earth to prove that pendulums swinging seconds are in general shorter as we approach the equator, the observations failed in exactness, as may be gathered from the twentieth proposition of the third book of Sir Isaac Newton's "Principia." Graham made a clock whose pendulum vibrated seconds of sidereal time, and having set it going in London, made several trials of its working: thus he compared it with the transits of the star Lucida Aquilæ over the meridian, and found the clock gained twelve seconds in ten apparent revolutions of the star. A brief description of the clock may interest some of my readers:—

The clock weight that keeps the pendulum in motion is 12 lbs. 10½ oz., and is to be wound up once a month. The weight of the pendulum itself is 17 lbs.; and during the time that the clock was compared with the transits of the star Lucida Aquilæ, it vibrated each way from the perpendicular 1° 45′. The magnitude of the vibrations was estimated by means of a brass arch, which was fixed just under the lower end of the pendulum-rod, and divided into degrees, &c.

August 31.—Mr Graham took off the weight belonging to the clock, and hung on another of 6 lbs. 3 oz., and with this weight the pendulum vibrated only 1° 15′ on each side, and the clock went slower 1½ seconds in 24 hours, than when its own weight of 12 lbs. 10½ oz. was hung on.

On comparing the vibrations, it appears that in one apparent revolution of the stars the clock went 2 minutes 6 seconds

slower in Jamaica than in London: deducting, therefore, $8\frac{1}{2}$ seconds, on account of the greater heat in Jamaica, there remains a difference of 1 minute 58 seconds, which must necessarily arise from the diminution of gravity in the place nearest the equator.

"Now," continues Dr Bradley, "if we suppose, with Sir Isaac Newton, that the difference in the going of a clock is owing to the greater elevation of the parts of the earth towards the equator, it will follow from these observations, and what is delivered by him in the twentieth proposition of the third book of his 'Principia,' that the equatorial diameter is to the polar as 190 to 189; this difference between them being $41\frac{1}{2}$ miles, which is somewhat greater than what Sir Isaac Newton had computed from his theory upon the supposition of an uniform density in all the parts of the earth." *

It should, however, be mentioned here that the theory of the Figure of the Earth with strata of different densities was then imperfect, and was not brought to its present state till the time of Clairaut. Treated by that theory, the change of rate here observed gives nearly the same Ellipticity of the Earth as is now recognised, namely $\frac{1}{300}$.

In Mr Edward J. Wood's "Curiosities of Clocks and Watches," p. 126 (London: Bentley, 1866), the following paragraph occurs:—"Clocks have been applied to other purposes than the mere simple measurement of time. George Graham, an eminent horologist, applied the movement of a clock, showing sidereal time, to make a telescope point in the direction of any particular star, even when below the horizon."

I do not know on whose authority the above statement is made, but if its correctness be admitted, then to Graham must be assigned the invention of the

* "Philosophical Transactions," No. 432, vol. xxxviii. p. 302; or Dr Bradley's Works, p. 62, &c.

driving clock as applied to equatorially-mounted telescopes. The early application of clock-work to this purpose seems involved in some obscurity. Sir George Shuchburgh, who has given the most complete account of equatorials, in his description of the "Shuchburgh Equatorial," now at the Royal Observatory, Greenwich * ("Philosophical Transactions," 1793)—remarks, "M. de Saron, in 1775, showed me a small reflector upon an equatorial stand, with some wheel-work to keep it constantly following a star," &c. Having no pretension whatever to solve this historical difficulty, I am fortunate in being able to cite so able an opinion as that of the Astronomer-Royal, who says in a private letter, "I have never seen a hint about Graham's invention of the equatorial clock, and do not believe it." Of the first specimens of a thoroughly effective driving clock, may be mentioned Shuchburgh's equatorial, still in use at Greenwich; that of the great Dorpat refractor by Fraunhofer; and that invented by the Rev. R. Sheepshanks, and presented by him to Admiral Smyth.

MAGNETIC OBSERVATIONS.

Mr Graham's observations "On the Variation of the Horizontal Needle at London, in the latter part of the year 1722 and beginning of 1723" ("Philoso-

* The Astronomer-Royal is so good as inform me that the Royal Observatory possesses a curious old equatorial, that had been set down by his predecessors as an instrument of Flamsteed's, but he found, on more careful examination, that it was a genuine equatorial of which mention had been made in Rigaud's "Bradley." It is quite rough in inessential parts, and well worked in essential parts. As Graham was so completely the instrument-maker for Bradley and the Observatory, the present Astronomer-Royal has no doubt it was made by Graham.

phical Transactions Abridged," vol. vi. Part II. p. 290), had better be given *in extenso*:—

The figure of the three needles with which the experiments were made was prismatic. Their lengths were nearly 12·2 inches; their ends, which pointed to the divisions, being filed to an edge, which made a fine line perpendicular to the horizon. The caps of two were of crystal, the other of glass. They were well polished on the inside, in that part which touched the pin they moved upon. The box was brass, and of a breadth sufficient to admit of 20° on each side the middle line, and covered with a piece of ground glass. The circular arches at the ends were raised so much above the bottom of the box, as to have their upper surfaces, upon which the divisions were cut, lie in the same plane with the needle, and at such a distance from each other that the needle might play freely between them. A few of the degrees at the north end were divided into six equal parts, each division being 10′. It was easy, by the help of a convex glass, to determine the pointing of the needle to less than a quarter of these divisions, or to about 2′ of a degree. The pin upon which the needle moved was of steel, hardened and ground to a fine point; and by a spring placed in the box the needle might be raised from off the point, and let down again at pleasure, without removing the glass or disturbing the box. By these means both the sharpness of the point and the polish of the cap were better preserved from injury when there was occasion to move the box. A small piece of brass was made to slide upon that end of the needle which pointed to the south, for readily bringing it to a horizontal position; for, according to the different strength of the touch, the north end of the needle will dip more or less. The bottom plate of brass was a little broader and longer than the box, and its edges made lines exactly parallel to the middle line of the divisions; and for the greater security of placing the box in a right situation, there was a brass ruler of thirty inches long, having its edges even and parallel, except part of that edge which was applied to the side of the box, which was a little filed away on the middle, that the side of the box near its ends only might touch the ruler. By this contrivance the two points of contact were as far asunder

as the length of the box would admit of, and the other edge of the ruler making a longer line than the side of the box, afforded a better direction for giving it the same situation.

For determining the quantity of the variation, I got a meridian-line stretched upon the top of the house between the rails of the leads, which were above fifteen feet asunder, and the line was a little more than thirty-nine inches above the leads. As this line was fastened to two pieces of brass that were fixed in the rails, and was above fifteen feet long, no sensible error could arise in putting it up at any time. The compass-box was placed upon a wooden stool with three feet, that had nothing of iron about it, and its top set level by a plumb-rule. But finding that in the open air the wind gave some disturbance, I put up another line, after the same manner, in a room two pair of stairs high. This line was about the same length with the other, and thirty-nine inches above the floor. Some time after I put up a third line, of the same length, in the room over this. By the method made use of in fixing these lines they could not differ above 2′ of a degree from the meridian, or from one another. Before I had made any trials, I imagined no other difference would arise than what might be occasioned by the friction of the needle upon the point it was to move upon, and having found that considerable in all the needles that I had taken notice of, I took more than ordinary care to provide against it, and succeeded beyond my expectation. For I have several times observed all the three needles return so exactly to the same place, that I could not perceive the least difference; as likewise all three to agree very nearly about the same time when they have been placed in the same box immediately one after another, the box remaining unmoved. The first needle I made was a little above three-tenths of an inch broad, about ·06 in thickness, and weighed about an ounce troy, the cap of crystal. After some trials with this needle it was made narrower, not to exceed half-a-tenth of an inch, and it then weighed five pennyweight and five grains. The second needle was at first about three-tenths of an inch broad, and ·04 thick, the cap of glass; and after several trials it was made so much narrower, that its breadth was a little less than its thickness, and it weighed two pennyweight and five grains. The third was nearly of the

same dimensions with the second, and weighed two pennyweight and three grains. When the two first needles were made narrower, care was taken that the files made use of for filing the north ends, touched not the south ends; and after they were made lighter, I tried them both before they were fresh touched upon the stone, and found no sensible difference in their direction. The reason of making the two first needles so heavy was to try whether they would return more constantly to the same situation than lighter ones. But notwithstanding, each of them would settle very exactly in the same place for a great number of trials made immediately one after another, yet I found them at different times to differ considerably from their former directions.

This occasioned my making them narrower, fearing their breadth had been some way concerned in this irregularity. But after the alteration, I found the same thing happened, though I could find nothing of it to proceed from any friction upon the point. This made me prefer the lighter needles, as less apt to injure the point they moved upon, and as exact in returning to the same situation. After many trials, I found all the needles I made use of would not only vary in their direction upon different days, but frequently at different times of the same day; and this difference would sometimes amount to upwards of half a degree in the same day, sometimes in a few hours. And this alteration I observed, whether the needles were drawn aside immediately before the observation, or suffered to remain undisturbed; for I have left the box standing for several days together without ever disturbing the needle, only have taken notice what it pointed at, and the time of the day, and I could sometimes perceive in a few minutes a very sensible alteration. But whether it stood near its greatest or least variation, or whether I drew the needle to one side with a key a few degrees or a greater number, it would constantly return to the same place it stood at immediately before. Sometimes I have taken the needle out of the box, and put it in again, and this I have repeated several times in the space of an hour. At other times I have taken down the box from off the stool, and put it up again, but have found no alteration in its direction; so that I found it of no consequence, whether the needle was drawn aside

or let alone, the shaking of the floor by walking upon it, or the trembling of the house by the coaches in the street, was sufficient to overcome the small friction upon the point. When I made the observations, I was very careful to have no keys nor iron about me that could affect the needle.

The box was placed in the room above the distance of six feet from the nearest wall, and above thirteen feet from the grate in the chimney, and no iron could at any time be brought near it without my knowledge. Yet after all, I am not satisfied that it was out of the reach of iron, and that the variation shown by it is the true quantity; but I am very sure there was no change of circumstances in the room that could affect it, for if there were any such materials in the wall or floor, their distances and situations continued the same. But for a farther confirmation of this irregularity, I put one of the needles into a wooden box, with a few degrees divided as the other, and placed it at the same meridian-line, at the distance of three feet and a half from the other, and found both needles nearly agreed in their alterations. The needles were all touched by that excellent loadstone presented to the society by the Lord Paisley. It may not be improper to take notice that the needles were not touched upon the naked stone, but with its armour on, generally upon that part of the capping nearest the poles; but I could not find a difference in the direction by touching upon another part. I may add, that when I have observed the needle increasing or decreasing in its variations, I have very frequently, with a key, drawn it in the contrary way several degrees, and then letting it return very gently till it has been within a degree, or less, of the place it stood at immediately before. I have then stopped it for some time, by holding the key at a proper distance, and withdrawing my hand gradually, have tried to make it stand short of its former place, but could never succeed. By this method, and several others made use of, I am well assured these changes in the direction are owing to some other cause than the friction of the needle upon the pin; but what that cause is I cannot say, for it seems to depend neither upon heat nor cold, a dry or moist air, clear or cloudy, windy or calm weather, nor the height of the barometer. The only thing that has any appearance of regularity is, *that the variation has been generally greatest, for*

the same day, between the hours of twelve and four in the afternoon, and the least about six or seven in the evening.

From February 6, 1722, to the 10th of May following, Graham states:—"I have made above a thousand observations in the same place, and the greatest variation westward was 14° 45′, and the least 13° 50′. It was seldom less than 14°, or greater than 14° 35′."

About the same time Graham made a great number of experiments with the dipping needle ("Philosophical Transactions" for 1725, p. 332; or "Abridgment," vol. vi. part ii. p. 280).

The following is the description of the dipping needle made by Graham, and used in the observations:—

About the time I was observing the variation of the horizontal needle, I made likewise some experiments with the dipping needle, to try if the dip and vibrations were constant and regular. The needle I made for this purpose was twelve inches and one-tenth long, half an inch broad in the middle, but not above one-tenth near the ends; the ends themselves being filed to fine edges; and in thickness it was about one-third of a tenth. The ends of the axis, upon which the needle turned, were very smooth, and not bigger than was necessary for the support of the needle, which weighed nine pennyweights twenty-one grains, or about half an ounce *Troy*. The ends of the axis were placed upon the edges of two thin plates of steel, that were hard and well polished, and parallel to the horizon, that the needle, when vibrating, might roll, and slide upon the edges of the plates, to avoid the friction they would have been subject to, by moving in holes. A brass semicircle was provided, and from the lowest point graduated each way, and a few of the degrees, about that part of it which answered to the dip, were divided into six equal parts. By the help of screws, the semicircle could be brought to a due situation; and by two spirit-levels, placed at right angles to each other, any change of situation was easily perceived, and by the screws it could be readily

restored to its former position; all was enclosed with glass to secure the needle from being disturbed by the motion of the air. I must here take notice of the great difficulty there is of poising the needle so exactly, before it is touched with the loadstone, as to take any position indifferently: for, when it is pretty near the truth it is extremely troublesome to place it at rest in the position desired, in order to try which way it is inclined to move. It cannot be done in the open air; for the least motion of it will disturb the needle, and when it is shut up, it is no easy matter to settle it in the place intended. And that there will be a sensible difference of the dip, upon shifting the sides of the needle, whatever pains be taken to prevent it, I am fully satisfied from the following experiments.

Here follow the details of his observations, from which it appears that the dip of the needle in the latitude of London, in the year 1723, was somewhat over 74°; it is now, in the year 1874, 67° 42′.

The reader will not fail to observe in the above recital another proof of Graham's remarkable skill as a mechanician, for there is no instrument that requires more delicate workmanship than the dipping needle.

On the 21st April 1748, Mr Graham read to the Royal Society ("Philosophical Transactions Abridged," vol. x. p. 698) his "Observations, made during the last three years, of the Quantity of the Variation of the Magnetic Horizontal Needle to the West." His first observation, March 26, 1745, indicates 17°; his last, January 4, 1747, is recorded 17° 40′.

The inclination of the dipping needle had been during the same time about 73½°. The dip at present is about 67° 42′.

"*N.B.*—As the variation of the needle at London has not been regularly published from time to time in the 'Philosophical Transactions,' it may not be improper to take notice here, that according to the best obser-

vations extant, and which were made by persons of great skill and exactness, the needle at London declined to the east 11° 15′ in the year 1580. In 1657 there was no variation, the needle then pointing due north. In 1672 the variation was observed by the late Dr Halley 2° 30′ towards the west, and in 1692 6°. And towards the beginning of the year 1723, it was found by Mr Graham, from the medium of a vast number of observations, to be then 14° 17′ the same way. So that during the course of 167 years elapsed since the year 1580 to the end of the last year 1747, the magnetic needle at London has moved to the westward 28° 55′."

In 1815 the variation was 24° 27′ west: it has now diminished to about 19°.

ASTRONOMICAL WORK.

In the foregoing pages it has been shown that Graham was not only the best of workmen in clock and watch making—in both of which departments he realised valuable inventions—but an apt student of magnetic phenomena, a knowledge of which demands patient research, nicety of experiment, and no small powers of deduction on the part of the investigator. Both his art and his science claimed high consideration—the latter especially, fraught with interest since the discovery of the New World by Columbus, was likely to become of paramount importance to the mariner and physicist. Other paths of inquiry for which he had a *penchant* were being made known, the pursuit of which was calculated to test all his powers as a mechanician. The discoveries of Tycho Brahe, of Galileo and Newton, had awakened the world to

the grandeur of the study of things celestial as well as things terrestrial; and astronomy, as a science, came to the front, and proved itself worthy of the scientific fervour of its promoters. Now an essential step to the development of the truths of astronomy rested on the use of instruments possessing unerring aim and the finest possible adjustment of their parts.

Here it may be well to notice Graham's inventive powers in "graduation," or the art of dividing mathematical and astronomical instruments. In this process of dividing the arcs of quadrants, theodolites, measures, &c., into degrees, the greatest accuracy of operation was imperative. The earliest efforts in dividing seem to have been those of Hooke and Roemer—the former assisted by Tompion. But as the author of an excellent article, probably the Rev. R. Sheepshanks, in the "Penny Cyclopædia" justly remarks—

> The art of dividing assumed a new form under the celebrated Graham—the father of all good clock, watch, and instrument making in this country, and the worthy associate of Bradley. He pointed out the fundamental principle of original graduation, that you can divide a given line accurately into two parts, but not into three or five equal parts. The dividing-tool employed by Graham was the beam-compass, a straight rod of wood or metal, on which perpendicular points of steel are fixed. Now if a line or arc is to be bisected, the points of the beam-compass are placed *nearly* at the distance of half the line, or the chord of half the arc between the dots. One point is placed in one dot, and a faint arc is struck with the other point towards the distant dot, and this operation is repeated with the second dot as a centre. The two faint arcs will either include a small space, or leave a small space between them, which can be most accurately divided with a pointer by the hand, aided by a magnifying lens. In the mural quadrant which Graham erected at

Greenwich, he carried this principle into full operation. The beam-compass which was used for drawing the divisional arc of the quadrant was used for setting off the chord of 60°; this was bisected, and the radius being again set forward from 30°, he had the quadrant exact. The arc of 60° was divided by continual bisections into 64 (or 2^6) equal parts, and the arc of 30°, in like manner, into 32 (or 2^5),parts. The subdivisions were [probably the author meant the divisions were subdivided, &c.], on the same principle, into 16 parts each. This division of the quadrant into 96 parts was continued as long as quadrants remained in use; but the trouble of reducing every observation into ordinary degrees, minutes, and seconds, was a considerable increase of labour to the observer.

Graham's "graduation" work held good till John Bird, the famous Durham cloth-weaver, devoted his attention to the subject. His skill as a workman, and the care he took to avoid errors arising from the partial expansion of the quadrant or tools during the operation, gained him great and merited reputation, but, adds the cyclopædist, "we are inclined to doubt whether in engineering or theoretical accuracy of division he made any step beyond Graham."

After Graham and Bird came Jesse Ramsden, a cloth-worker in Halifax, whose "dividing-engine," and other improvements in the manufacture of astronomical instruments, earned him the Copley Medal of the Royal Society in 1795. The art that had been so signally advanced by Graham, Bird, and Ramsden, was further extended by the ingenious Edward Troughton—the Copley Medallist of 1809. Troughton's biography will be discussed in a future page; in the meantime, it may be observed that the two Cumbrians, George Graham and Edward Troughton, accomplished more for the art of "dividing" than any two men during the past two centuries.

In proceeding to notice Graham's astronomical instruments, the reader's interest will be best consulted by a quotation, no less descriptive than historical, of the zenith sector, from the pages of Dr Pearson's works:*—

"The zenith sector, like the transit instrument, can be used only on the meridian, and its measures are referred to the zenith-point of the place of observation. Its principal uses are to determine the latitude of the place of observation by a star of known zenith distance; to measure the zenith distance of a star in a known latitude; and to ascertain the zenith-point, and, by comparison, to transfer it to the arc of another instrument, such as the astronomical quadrant, that is not capable of being reversed in position. The first zenith sector was contrived and constructed by the ingenious Dr Hooke, with an intention of determining whether or not a fixed star has a measurable annual parallax, as Galileo had suggested. An object-lens of thirty-six feet focal length was fixed in a vertical tube in the year 1669, with a plumb-line suspended from the superior, and a graduated arc placed near its inferior end."

It appears from the Cutlerian lectures of the Gresham Professor that the instrument gave uncertain results. This fact coming under the notice of the Hon. Mr Molyneux, led to Graham being consulted.

"The Hon. S. Molyneux, conceiving that a sufficient trial had not been made of Hooke's instrument, availed himself of the mechanical skill of George Graham, who, in the year 1725, put up a zenith sector of twenty-four feet and a quarter focal length at Kew,

* Rev. Dr Pearson, *loc. cit.*, pp. 531, 532.

by the assistance of Bradley, about the end of November, and γ Draconis was observed by it for the first time on the 3d of December following. On the 5th, 11th, and 12th, no sensible difference appeared in the zenith distance of the star, and it was concluded that the instrument proved perfect; but Bradley, being still at Kew on the 17th, and still more on the 20th of the same month, perceived a change towards the south, which being in a contrary direction to that which would have been produced by parallax, caused various conjectures as to the true cause of this apparent change of declination. About the 26th of March 1726, the star was found more towards the south by 20″ than on the 3d of the preceding December; about the middle of April the change began to be retrograde; at the beginning of June the star had returned to its original position; and in September following the motion towards the north had increased to 20″ nearly. In December it was found again in the original situation. To ascertain what might be the real cause of this apparent change in the place of γ Draconis, and of other stars that had been observed to have changes, but not of the same quantity, nor yet contemporaneously, Bradley determined to have a second instrument constructed by Graham, to be set up for his own convenience at Wanstead, which was accordingly done on the 19th of August 1727. The dimensions of this second instrument were guided by the situation that Bradley had fixed upon for its erection, which limited the focal distance to 12½ feet, and its total arc to 12½°, which enabled the observer to take Capella into the field of view, and to see about 200 stars contained in the 'British Catalogue.' Bradley

gave a paper to the Royal Society of London, entitled, 'A New Apparent Motion of the Fixed Stars Discovered' (No. 406), which is contained in vol. vii. p. 149, of the 'Philosophical Transactions,' abridged by Eames and Martyn in 1734, in which he has detailed the circumstances that led to the discovery of the *aberration of light* by means of Graham's second zenith sector, which, at Bradley's appointment to the Royal Observatory at Greenwich, most fortunately for astronomy, was taken thither, and is the identical instrument that is still there, and yet held in high estimation. The discovery of *nutation*, though previously suspected to exist, was afterwards discovered by a series of twenty years' observations."

This zenith sector of Graham's has only been superseded of late years by two greatly improved instruments constructed mainly on the same principles, and devised by Sir G. B. Airy, the present Astronomer-Royal. One of these is known in the Ordnance Survey as "Airy's Zenith Sector." Its element of reference is spirit-level instead of plumb-line. The other is the "Reflex Zenith Sector," applying only to the observations of γ Draconis at Greenwich, and scarcely admitting of being used elsewhere.

The Astronomer-Royal, with his usual courtesy, informs me that Graham's *quadrant*, and a similar *quadrant* by Bird, were in use at the Royal Observatory till 1811. Then Troughton's *circle* was introduced by Pond, the then Astronomer-Royal, and before long Reichenbach's *circles* on the Continent; and no more quadrants were made. The present Astronomer-Royal adds: "In 1829, I travelled through a good many observatories on the Continent, and was struck

with seeing how many quadrants, exact copies of Graham's or Bird's, were still retained as instruments of the highest class."

Nothing is more remarkable in the progress of physical science than the fact that many of the greatest discoveries which have been made have resulted from a diligent pursuit of a series of observations undertaken for a totally different object. Thus the grand discovery of the aberration of light resulted in an attempt to detect the annual parallax of the fixed stars.

Professor Grant justly observes:*—"The absence of any appreciable change in the position of the fixed stars, when observed at opposite extremities of the terrestrial orbit, was one of the earliest, as it was unquestionably the most serious objection that had been urged against the earth's motion, and it was always considered that the detection of such a change by observation would furnish an irrefragable proof that the earth is not the centre of the solar system.' Bradley's celebrated observations at Kew and Wanstead, and afterwards at Greenwich, where he succeeded Halley as Astronomer-Royal in 1742, were undertaken solely with a view to the discovery of the parallax of the fixed stars."

It is now admitted that, admirable and exquisite as were Bradley's instruments (made by Graham), they were powerless, by reason of the extreme minuteness of the quantity to be discovered, to cope with so delicate a problem as that of parallax; but they were incomparably superior, both theoretically and practically,

* "History of Physical Astronomy from the Earliest Ages to the Middle of the Nineteenth Century," p. 336, by Robert Grant, F.R.A.S. (London: Baldwin. 1853.)

to any which had as yet been employed in those delicate researches, and their skilful use led to the two great discoveries which will hand Bradley's name down to all time—viz., the aberration of light, and the nutation of the earth's axis. Graham seems to have been the only artist of that day capable of turning out instruments accurate enough to furnish the observations which led to these discoveries. Bradley* in the paper announcing his discovery of aberration of light, read before the Royal Society, thus speaks of Graham's workmanship:—

"This indeed was chiefly owing to our curious member Mr George Graham, to whom the lovers of astronomy are not a little indebted for several other exact and well-contrived instruments. The necessity of such will scarcely be disputed by those who have had any experience in making astronomical observations; and the inconsistency which is to be met with among different authors in their attempts to determine small angles, particularly the annual parallax of the fixed stars, may be a sufficient proof of it to others. Their disagreements, indeed, in this article is not so much to be wondered at, since I doubt not but it will appear very probable that the instruments commonly made use of by them were liable to greater errors than many times that parallax will amount to."

The following passage is a still more remarkable proof of Bradley's appreciation of the debt he owed to Graham for furnishing him with the means which led to his great discoveries:—

"A mind, intent upon the pursuit of any kind of

* "Miscellaneous Works and Correspondence of the Rev. James Bradley, D.D., F.R.S.," p. 2. (Oxford University Press. 1832.)

knowledge, will always be agreeably entertained with what can supply the most proper means of attaining it. Such to the practical astronomer are exact and well-contrived instruments; and I reflect with pleasure on the opportunities I have enjoyed of cultivating an acquaintance and friendship with the person that, of all others, has most contributed to their improvement. For I am sensible that if my own endeavours have in any respect been effectual to the advancement of astronomy, it has principally been owing to the advice and assistance given me by our worthy member Mr George Graham, whose great skill and judgment in mechanics, joined with a complete and practical knowledge of the uses of astronomical instruments, enable him to contrive and execute them in the most perfect manner.

"The gentlemen of the Royal Academy of Sciences, to whom we are so highly obliged for their exact admeasurement of the quantity of a degree under the Arctic Circle, have already given the world very convincing proofs of his care and abilities in those respects; and the particular delineation which they have lately published of the several parts of the sector which he made for them, hath now rendered it needless to enter upon any minute description of mine at Wanstead, both being constructed upon the same principles, and differing in their component parts chiefly on account of the different purposes for which they were intended."

It is impossible to turn over the pages recording all the details of Bradley's observations at Kew and Wanstead without being struck by the fact that Graham seems not only to have been the artist

who made the instruments used by Molyneux and Bradley, but that he was constantly associated with them at Kew in actual observation. All these observations are published in minute detail, and throughout we find such memoranda as these by Mr Molyneux:—

"Mr Graham carefully examined the instrument again, and adjusting it again to the plumb-line, the index stood at 10⅛.

"I left it so; and then Mr Graham lay down, and at first could not perceive the star, it was so truly on the thread.

"1726, January 7.—Mr Graham here. . . . Mr Graham also saw the star truly bisected.

"1726, March 22.—Observation made by Mr Graham."

Graham was evidently a frequent visitor at Kew, adjusting and improving the instruments, and constantly sharing the labour of observation.

The most friendly relations existed between Molyneux, Bradley, and Graham—with whom there was a total absence of all rivalry or jealousy. This is further established by the correspondence between the English and French *savans* on physical science, occupying a large portion of Bradley's "Miscellaneous Works;" in which letters will be found to Graham from Maupertuis, Bradley, and others, all of which indicate a thorough and hearty appreciation of his ingenuity and skill in promoting their astronomical pursuits. Perhaps it may be worthy of notice that a number of experiments to determine the length of the pendulum vibrating seconds at Greenwich were made in 1743, 1744, and 1749, by means of apparatus

constructed by Graham (Bradley's "Miscellaneous Works," p. 385–87). And in watching the comet of 1757, certain observations were taken with a "curious sector constructed for such purpose by the late ingenious George Graham, of which Dr Smith has given a very exact description in his third Book of Optics" (*loc. cit.*, p. 56). But there is no need to confine one's self to English authorities on astronomy, as every work on this subject, whether published in Copenhagen, Berlin, St Petersburg, or any other Continental city, contains honourable mention of Graham's important services to the science.

Professor Grant,* in his historical notice of the celebrated Dr Edmund Halley, Astronomer-Royal in the early part of the eighteenth century, records that in 1726 a mural quadrant for the observation of zenith distances, as well as differences of right ascension, was erected at Greenwich.

This instrument was constructed by the celebrated artist Graham. It was made of iron, and had a radius of eight feet. The limb was composed of two arcs, upon each of which a different mode of division was executed. The inner arc was divided to every 5′, according to the ordinary sexagesimal scale, and was afterwards subdivided by means of a vernier to every 30″, which again might be subdivided by estimation to one-fourth of this quantity, or 7½″. The outer arc was divided, first into ninety-six parts, and then each of these into sixteen smaller parts, each of which again was subdivided by means of a vernier to every 13″, and each of these parts might finally be subdivided by estimation to 5″ or 6″. In making observations with the instrument both modes of reading off were employed, so that the one might serve as a check upon the other; but in cases of discordance greater reliance was usually placed on the indications of the outer arc. Halley commenced his observations with

* *Loc. cit.*, p. 478.

this instrument on the 20th of October 1725. Henceforward he continued to observe, not only the transits of the celestial bodies over the meridian, but also their zenith distances.

The historian of physical astronomy has been led to form the highest estimate of Graham, whom he thus describes:—"He was not only the most skilful artist of his time, but was also distinguished by a profound acquaintance with various subjects of natural philosophy. Besides the mural quadrant described above, he constructed the famous zenith sector with which Bradley discovered the phenomena of aberration and nutation. It was also with a zenith sector executed by the same artist that the French Academicians who measured the length of an arc of the meridian in Lapland determined the latitudes of their stations."

It may be appropriately mentioned here, that on the recommendation of Sir G. B. Airy, Bradley's (Graham's) zenith sector was sent to the Cape of Good Hope for the astronomical observatory connected with the measure of the arc of meridian; and was so used from 1838 to 1848. Before it went, Sir George thoroughly examined it, and drew up a complete description, illustrated by engravings, which are published in the "Verification and Extension of La Caille's Arc of Meridian." It was returned to Greenwich, and is now in good order, suspended in the Transit Circle room.

STANDARDS OF LENGTH AND WEIGHT.

In "An Account of the Proportions of the English and French Measures and Weights, from the Standards of the same kept at the Royal Society," read to

the Society, November 11, 1742, it appears that the Royal Academy of Sciences at Paris and the Royal Society of London proposed that accurate standards of the measures and weights of both nations be carefully examined, and made to agree with each other. Graham was appointed by the Royal Society to look after this important business. MM. Du Fay and Abbé Nollet represented the French Academy.

On June 16, 1743, or seven months later, a further account was furnished to the Royal Society, embracing a description of the "standards of measures and weights in the Exchequer, and some others kept for publick use at Guildhall, Founder's Hall, the Tower, &c." In the investigation of these standards Graham was accompanied by Ministers of State and other eminent persons. He was provided with "very exact and curious beam-compasses," adapted to the various objects in view. "All which compasses were severally so contrived as to be lengthened by the turning of a fine screw, one of whose revolutions answered accurately to the fortieth part of an inch, and to which there was applied an index, showing on a small circular plate, with twenty divisions, the broken part of a revolution, and whereon the place of the index might by the eye be estimated to about the tenth part of a division—whereby the motion of the movable cheek, end, or point, might consequently be judged of to about the 8000th part of an inch." Lest this minute division should be taken as a literal fact to be verified every day, he showed the difficulties in the way of accuracy arising from the eye, when aided by magnifying glasses, as well as the hand; and what he thought possible, under all circumstances, would be

to take such measures as the above to the 1600th part of an inch.

It is to be regretted that nothing more was done than instituting a comparison of the French and English standards, to be recorded in the archives of the French Academy and Royal Society, when an opportunity offered of assimilating the weights and measures of the two countries.

In the "Philosophical Transactions" for 1748, pp. 416, &c., are "Tables of specific gravities, extracted from various authors, with some observations upon the same, communicated in a letter to Martin Folkes, Esquire, President of the Royal Society, by Richard Davies, M.D." In this communication Dr Davies states, "Mr George Graham, F.R.S., made for me, at the request of a friend, some accurate trials upon the weight of gold and silver, both when reported fine, and when reduced to the English standard; all which I have inserted under his name in the following tables." The contributions by Graham are the following:—

TABLE I.

Page 436.	A medal of the Royal Society, reported fine gold, ...	19·158
Page 437.	A five-guinea piece of King James II., 1687, with an elephant, ...	17·933
	A Portugal piece of £3, 12s., 1731, supposed to be nearly the same as standard, .	17·854
	A silver medal of the Royal Society, reported fine silver, ...	10·484
	A new crown piece, 1746, *Lima* under the head, ...	10·284

MISCELLANEOUS OBSERVATIONS.

Mr Graham's "Observations of an Extraordinary Height of the Barometer," made on December 21, 1721, seems to have been the first communication made by him to the Royal Society, of which Society he was then a Fellow. The height of the quicksilver rose a little above 30·8½ inches ("Philosophical Transactions," vol. xxxi. p. 222; or "Abridgment," vol. vi. part ii. p. 28). There are numerous notices in the "Philosophical Transactions" of astronomical data furnished by Mr Graham from the year 1722 to the year 1743, such as occultation of the stars and planets by the moon, solar and lunar eclipses, and various casual phenomena, all which tend to prove that he was not only an efficient maker of philosophical instruments, but thoroughly capable of using them in the field of astronomy. His observations were made in Fleet Street, London, occasionally aided by his friends, James Short, F.R.S., and Dr Bevis, and are to be found in vols. vi., vii., and viii. of the "Abridgment of the Philosophical Transactions."

A list of Graham's contributions to the Royal Society is appended to this Memoir.

At the request, it is said, of the Right Hon. the Earl of Macclesfield, George Graham consented to have his portrait taken by Hudson, which was afterwards engraved in mezzotinto by J. Faber. From Faber's engraving the portrait in the frontispiece of this volume is derived. Judging from it, Graham

seems to have been a man of considerable stature. His physiognomy offers strongly-marked features, and of a northern type that is by no means rare in the Border district. His wig interferes with a just appreciation of his cranial capacity, but there is enough visible of his frontal development to indicate the man of clear discernment, shrewd intellect, and power. His visage is long, his eyebrows large, but not overshadowing clear observant eyes; his nose is prominently marked, whilst his lips and chin show a less masculine type than the rest of his facial features. There can be little hesitation in inferring from the study of his portraiture that he was endowed with thoughtfulness, acumen, and fixedness of purpose. Along with his self-possession there seems to breathe an air of *complaisance* and kindly feeling; but the most tangible manifestation in his portrayal is strength of mind, with large perception and general knowingness of character.

A collarless coat, buttoned up in the front, with full skirts and ample outside pockets, upturned sleeves giving freedom to the wrist, and the opportunity of displaying white linen, breeches buckled at the knees, and strong hosiery covering the lower limbs, constitute his habiliments. He is seated on a big armchair; upon his knees rests a three-cocked hat holding his gloves, and a portion of his right hand, whilst his left hand rests on a table near to a book. A portion of a clock, with a glass front showing the mercurial pendulum, graces the wall of the apartment—a fitting, or rather, it may be said, an historical adjunct to his portraiture. It should be observed that the words, "George Graham, clock-

maker," are printed beneath the engraving; but none of his titles are given, not even the F.R.S.—and this was said to have been done at his own request.

Not a word has come down to us bearing upon his domestic habits and social life. He appears to have remained in single blessedness, being too devoted to his vocation to find time to marry. He enjoyed good health, and had attained his seventy-fifth year without showing any signs of old age; then his hand became less equal to the nicer manipulations. However, he clung to his business that had been the mainstay and comfort of his life, fulfilling pretty much the meaning of the lines—

> "Time is—the present moment well employ;
> Time was—is past—thou canst not it enjoy;
> Time future—is not, and may never be;
> Time present—is the only time for thee."

And so continued till November 1751, realising what Dryden said in his Œdipus—

> "Till, like a clock worn out with eating Time,
> The wheels of weary life at last stood still."

He died on Saturday, 16th Novr. 1751, at his house in Fleet Street, London; and on Sunday, the 24th, "at night, his remains were carried in a hearse, preceded by three mourning-coaches with the gentlemen who were to support the pall, and followed by nine, to Westminster Abbey, and there interred in the same grave with the remains of his predecessor, Mr Tompion. The pall was supported by Dr Knight, Mr Watson, Mr Canton, Mr Short, Fellows of the Royal Society; Mr Catlyn and Mr Bird—all of them his intimate friends" (*Gentleman's Magazine*, 1751).

I can offer no explanation of the interment taking

place at night, unless it had been too long postponed; or that, occurring on Sunday, the services of the Church necessitated the step. As Tompion was supposed to have died of the plague, the opening of his grave for the reception of Graham's remains may have had something to do with this unusual procedure.

The last edition of the "Encyclopædia Britannica" bestows only twenty-one lines on George Graham's history. The "Biographie Universelle," to which allusion has been made in page 15, contains a more valuable notice of Graham, praising his inventive genius, his scrupulous care in the execution of all his machines and instruments, which were noted for superior exactness and precision. The writer refers to his profound knowledge of astronomy; and speaks of him as a sincere, confiding, and generous man, who devoted all his efforts to the progress of science and to the welfare of his fellow-beings.

In the *Gentleman's Magazine*, vol. xxi. pp. 523, 524, there is an obituary notice of George Graham from one of his own friends that may be worth noting; it has formed the basis of almost all—and that all is very little—that has appeared in a biographical shape regarding the celebrated clockmaker.

"That Mr Graham was, without competition, the most eminent of his profession, is but a small part of his character. He was the best mechanician of his time, and had a complete knowledge of practical astronomy; so that he not only gave to various movements for the measurement of time a degree of perfection which had never before been attained, but he invented several astronomical instruments by which considerable advances have been made in that

science. He made great improvements in those which had before been in use, and by a wonderful manual dexterity constructed them with greater precision and accuracy than any other person in the world." The writer then speaks of the "great mural arch in the Observatory at Greenwich," copies of which had been made by English artists for France, Spain, Italy, and the West Indies; of the zenith sector by which Bradley made his great discoveries; of Graham's comprising "the whole planetary system within the compass of a small cabinet," from which, as a model, all the modern orreries have been constructed; and his furnishing the French Academicians with proper instruments.

Alluding to his personal character: — "His temper was not less communicative than his genius was penetrating, and his principal view was not either the accumulation of wealth or the diffusion of his fame, but the advancement of science and the benefit of mankind. As he was perfectly sincere, he was without suspicion, as he was above envy he was candid, and as he had a relish for true pleasure he was generous. He frequently lent money, but never could be prevailed upon to take any interest; and for that reason he never placed out any money on government securities. He had bank-notes which were thirty years old by him when he died; and his whole property, except his stock-in-trade, was found in a strong-box, which, though it was less than would have been heaped up by avarice, was yet more than would have remained to prodigality.

The writer makes no comment on the property that Graham died possessed of, nor of its distribution

among relatives and friends. He had made a will, as he left £20 to the poor of the Company of Clockmakers, which sum was paid at the Christmas Quarter Court, on 18th January 1752, by Mr Bradley, his executor.

In the "Memorials of Westminster Abbey," by the Rev. Dean Stanley, it is stated that "in the centre of the nave, in the same grave, were laid the master and apprentice—Tompion and Graham—the fathers of English watchmakers, and that the slab over their grave was removed at the beginning of the century." Knowing that this change had called forth "many an indignant remonstrance," the good Dean had the slab restored to its proper place. Upon it is the following inscription:—

HERE LIES THE BODY
OF MR THO. TOMPION,
WHO DEPARTED THIS
LIFE THE 20TH OF
NOVEMBER 1713, IN THE
75TH YEAR OF HIS AGE.
ALSO THE BODY OF
GEORGE GRAHAM OF LONDON,
WATCHMAKER AND F.R.S.,
WHOSE CURIOUS INVENTIONS
DO HONOUR TO Y^E BRITISH GENIUS,
WHOSE ACCURATE PERFORMANCES
ARE Y^E STANDARD OF MECHANIC SKILL.
HE DIED Y^E XVI OF NOVEMBER MDCCLI
IN THE LXXVIII YEAR OF HIS AGE.

It was the boast of the great Napoleon that every private soldier in the "Grand Army" carried a marshal's baton in his knapsack. Now that the British army is reformed, it is to be hoped that the same privilege may be in possession of our subalterns. At no time, however, have the public services of England been wanting in men of true patriotic fervour and daring, prompted or not by the anticipated reward of a seat in the House of Lords, and interment among the honoured dead of Westminster Abbey or St Paul's Cathedral. Unfortunately for the occasion of such displays of lofty enterprise and national feeling, political and military events almost exclusively enjoy the privilege of exciting public attention. In civil life, excepting always the irrepressible law that ever continues to exercise an influence quite irreconcilable with our accredited astuteness as a nation, prizes for true merit are comparatively rare, though happily not so rare as they were twenty years ago. The great majority of those who make the industrial or fine arts, or the culture of the physical and natural sciences, their aim in life, must bow their heads to labour and a life-devotion to achieve success, whilst the highest public recognition they can hope to attain is the honour of enrolment among the members of a learned body—to which, however, no pecuniary rewards are due. It is true that the ways of peace and honest independence are glorious privileges; and if the man is blessed who makes two blades of grass grow where only one grew before, the artisan should be no less favoured whose ingenuity overcomes the obstructions in the path of science, and helps to reveal the imper-

turbable laws of nature in all their definiteness and exquisite brilliancy. Graham tramped to London with no baton, and no credentials extolling his youthful virtues; but he possessed what was infinitely better, and more conducive to his advancement in life, a keen intellect, large perceptive powers, great constancy of purpose, and a growing, and no less loving, interest in his work. Then his work was directed to a highly beneficial use, that of obtaining correct methods of measuring time, as aids to the exploration of the course of the heavenly bodies—truly desiderata of the highest consideration, that had engaged the best intellects of every age, none of whom, however, attained the success that happily befell the labour and inventive genius of George Graham, the clock-maker. He little augured on his way to London that he was marching to the Hall of the Royal Society, and the association of the great men of his epoch; that by the diligent use of his own faculties he would earn fame and honourable distinction both at home and abroad; and whilst he would live in the esteem of his contemporaries without creating in their minds a spark of jealousy or ill-will, that his mortal remains would be assigned a place among the departed great of England.

APPENDIX.

COMMUNICATIONS BY GEORGE GRAHAM TO THE ROYAL SOCIETY, LONDON.

Observations of an Extraordinary Height of the Barometer, December 21, 1721.

Observations of an Eclipse of the Sun, November 27, 1722, at London.

Observations made of the Variation of Horizontal Needle at London, in the latter part of the year 1722 and beginning of the year 1723.

Observations on the Dipping Needle, made at London 1723.

A Contrivance to avoid the Irregularities in a Clock's Motion, occasioned by the Action of Heat and Cold upon the Rod of the Pendulum.

An Observation on the Eclipse of the Moon, November 20, 1732, made at London.

An Observation of an Eclipse of the Sun, May 2, 1733, at London.

An Observation made in London by Mr Graham, and at Black River in Jamaica by Colin Campbell, concerning the going of a Clock, in order to determine the Difference between the Lengths of Isochronal Pendulums in those places.

Observations on an Eclipse of the Moon, March 15, 1735–6, at London.

Observations of an Eclipse of the Sun, September 8, 1736, at London.

Observations of an Occultation of Mars by the Moon, October 7, 1736, at London.

Observations of the Transit of Mercury over the Sun, October 31, 1736, at London.

Observations on an Eclipse of the Sun, February 18, 1736–7, at London.

Observations of an Eclipse of the Sun, August 4, 1738, at London.

Observations of an Occultation of Aldebaran by the Moon, December 12, 1738.

Observations of an Eclipse of the Moon, January 2, 1740.

Observations of an Occultation of Jupiter, and his Satellites by the Moon, October 28, 1740.

An Account of a Comparison lately made by some Gentlemen of the Royal Society of the Standard of a Yard, and the several Weights lately made for their use; with the original Standards of Measures and Weights in the Exchequer, and some others kept for public use, at Guildhall, Founders' Hall, the Tower, &c. November 11, 1742, and June 16, 1743.

An Account of the Transit of Mercury over the Sun, October 25, 1743.

An Account of the Eclipse of the Moon, October 22, 1743.

Some Observations made during the last three years [1745–1748] of the Quantity of the Variation of the Magnetic Horizontal Needle to the westward. April 21, 1748.

ABRAHAM FLETCHER,

TOBACCO-PIPE MAKER.

"The rank is but the guinea stamp,
The man's the gowd for a' that."—BURNS.

THE rivers and streams of Cumberland are acknowledged to possess a picturesque celebrity of their own, notably the Cauda and Eden; none of them, however, can be said to vie in attractiveness with the Derwent, that constitutes of itself both river and lake, and offers so many fascinating subjects for both pen and pencil. Rising from the lofty crags of Borrowdale, and rushing impetuously down to a lower level, it forms the charming lake of Derwentwater; on being joined by the Greta, it soon spreads into Bassenthwaite Water; then winding onwards to Cockermouth, and receiving other tributaries, finally falls into the Solway Firth at Workington. Its precipitous, rocky falls, its purling, pebbly streams, and the smooth expanse of its crystal lakes, are the admiration of potentates, philosophers, and poets, along with countless multitudes of English and American tourists. Nor is the loveliness and untold beauties of the scenery around the Derwent lost on the men of science; for there they

linger with pleasure and profit in the enjoyment of their favourite pursuits. The geologist looks with keen interest on the mighty structures that have arisen out of the cosmic chaos—the pinnacled heights, the softened round eminences, and the verdured plains; on these again the botanist culls his favourite ferns and mosses, and more richly-coloured flora. Reposing on its shaded banks, or sailing along its glassy surface, the statesman and merchant catch the buoyancy of spirit pervading all around, and readily forget their cares and anxieties; and whilst the poet, in this *toute ensemble* of an earthly paradise, derives happy sources of inspiration, the painter seeks to fill his canvas with those varied forms of loveliness that afford to the æsthetic mind the hearty appreciation of a thing of beauty being a joy for ever.

In its course from Cockermouth to the Solway Firth the Derwent passes through a narrow yet fertile vale, in part bounded by limestone ridges, on one of which, occupying the right bank of the stream, are situated the villages of "Great Broughton" and "Little Broughton," about three miles from Cockermouth. Little Broughton is hardly visible from the vale, but is of easy access from the Brigham station of the Cockermouth and Workington Railway; and both it and Great Broughton consist of a few farm dwellings and irregularly-built homesteads for the labouring class.

In the middle of the last century the population of Little Broughton consisted almost entirely of tobacco-pipe makers and weavers; the latter class of artisans were indigenous to every hamlet, when people grew and spun their own "lin," and made their own "grey

coats;" but why so small a village should have taken to pipe-making is not so very intelligible, more especially if the finer white clay* needful for the purpose had to be conveyed from Devonshire. As weavers and tobacco-pipe makers ruled as handicraftsmen; Quakers and Baptists constituted the only religious bodies in Little Broughton.

Springing from the loins of William Fletcher of Broughton, Joseph Fletcher, Baptist and tobacco-pipe maker, took Elizabeth, daughter of Benjamin Palmer of Little Broughton, for wife, who, in due season, presented him with five sons and two daughters. Adopting a custom by no means uncommon among Dissenters, the Fletchers named their children after the patriarchal and virtuous in biblical history—Abraham, Isaac, Jacob, Joseph, and David distinguished the boys, whilst the names of Ruth and Sarah obtained for the girls.

Abraham, the first-born, and the subject of this memoir, came to light on November 1, 1714, and realised nothing by his primogeniture but a hard, cheerless, and monotonous struggle for existence. He seems to have been kept at home to nurse the Isaacs and Jacobs, and to do any "little jobs" about the house, till his hands could be turned to pipe-making. His father's heart had been rigid enough, and his mother's not a whit better; and though recipients of adult baptism, both parents were of a rough nature, otherwise it may be inferred they would have given their oldest son some educational advantages pre-

* A notion prevails that the older branches of the famous Wedgwoods had a pottery near Broughton Moor, but found the clay of this district unsuited to their operations.

vious to binding him an apprentice to the trade of pipe-making. It must not be denied that Abraham was sent to school, and it is of some historical interest to know that each week's tuition cost his father a penny. Now this penny-a-week outlay seems to have been looked upon as much too costly a thing, judging from the fact of his being withdrawn from school at the end of the third week, and never again permitted to return. A threepenny schooling, realising the figurative idea of a drop in the bucket, may fairly be looked upon as the most infinitesimal dose of instruction ever recorded in the pages of biography.

Abraham was yoked to his father's trade at an early age, and worked right well. On reaching his teens of years, his thoughts, stirred by the intellectual and emotional feelings of puberty, made him dissatisfied with his mechanical labour and drudgery. He manifested an earnestness for something more consonant with his brain-power, and that something could only be obtained through the instrumentality of books. The parental threepence had failed to furnish him with the A B C's, so that he had necessarily to begin his self-education by thumbing the alphabet, then proceeding to spelling and writing. After a time, when he had acquired the art of reading, an achievement that afforded him no small pride, he fell in with a book on arithmetic, and set to work with all his might to master its contents. His exercises, it ought to be borne in mind, were only permitted free play after he had done a hard day's work; and assuredly hours of labour were not stinted in those days, especially when a family group constituted the copartnery in trade. It was early and late with the

Fletchers all the year round, and no lack of purpose conjoined with a rigid economy.

The rest of the household had retired for the night before Abraham could satisfactorily turn to his books and his labour of love. Had he met with any encouragement in his zealous pursuit after knowledge, he would have deemed himself one of the happiest of mortals; unfortunately, he not only derived no aid from his parents, but was subjected to much opposition and reproach—nay, worse than all, in those days of severe thrift, accused of waste and extravagance. And of what? Not the time demanded by his father, whom he served faithfully and well, and with every filial obligation; but the waste was the burning of a farthing rushlight,* and the extravagance was the use of the unburnt cinders left in the kitchen-grate after bed-time!

In the present day there is much talk on educational difficulties, and no small amount of pseudo-philanthropic sentiment touching the impediments in the way of the industrial classes seeking to raise themselves in the social scale; these obstacles are, however, but molehills in comparison with the mountainous acclivities that surrounded the handicraftsmen of a century and a half ago. Abraham Fletcher was conversant only with hard lines, severe toil,

* Joseph Fourier, when studying mathematics in the Military School of Auxerre, conducted at that time by the Benedictines, in his insatiable thirst for knowledge, collected the ends of candles from the kitchen, the corridors, and the refectory of the college, and lighted them on the hearth; whereby he illuminated his solitary studies, and prepared himself for those labours which were destined a few years afterwards to adorn his name, and to throw a lustre of greatness on his country.

rough usage, and an almost total absence of culture of every kind, whilst his artisanship afforded him neither political nor social status. To-day all things are changed; there is leisure and richness of opportunity to all men, an expanding circle of religious toleration and civil freedom, hourly intercourse with the community at large, cheap literature and an enlightened public opinion—in short, a golden age of advantages to all who try to catch the flowing tide that leads to individual happiness as well as the extension of our national prosperity. Yet, oddly enough, the present age hardly vies with the past in producing examples of individual effort and attainment, nor does it exhibit such frequency in the growth of great men from the lower social level. Our hardy forefathers, with their indomitable industry and thrift, showed more real character and achievement, and secured a larger amount of serviceable work, than would appear to arise from the highly-paid labour, comparative ease, and an almost feather-bed citizenship attendant on these latter days.

Abraham practised his daily art with nimble fingers, and contributed a fair moiety to the support of the family larder, whilst his night studies were continued *pari passu*, and often prolonged to the hours of early morning. Having experienced the drawbacks to a life of study such as befell John Frederick Bryant, the Westminster pipe-maker and poet, Fletcher might well adopt the lines which he addressed to a piece of unwrought pipeclay:—

> "Rude mass of earth, from which with moiled hands
> (Compulsive taught) the brittle tubes I form,
> Oft listless, while my vagrant fancy warm
> Roves, heedless of necessity's demands."

Such severe efforts would have unstrung the mental and bodily powers of ordinary lads, but Abraham's vital and nervous forces, like his own modelling-clay, were plastic, pliable, and pithy. Each day added to his stock of knowledge, and each day rendered him more buoyant and hopeful. When he triumphed over reading, he had gained the first goal of his ambition—the power to benefit by other people's labours and ideas embodied in the general literature of the day. On acquiring a knowledge of rudimentary arithmetic, he had the pleasure of being able to count the cost of merchandise, and to see the relations of figures to trade and commerce. Step by step he reached the mathematical ladder, and, whilst engaged at his daily work, endeavoured to concentrate his thoughts on the problems that had tried his skill on the previous night. It was in this plodding way, and with Sundays at his disposal, that he gradually acquired a vast amount of information, and became a distinguished algebraist.

The acumen and growing wisdom of Abraham should have tended to soften the parental disregard of book-learning; nor is it easy to understand why he continued to subject himself to hard words and harder cuffs, when his hands fitted him to earn his own porridge and milk, and to clothe himself in the grey-woollen vestments of bucolic life. His servitude was a kind of Helotism, yet he stuck to his home colours like a true Spartan, or, if you will, a modern Teuton of the best breed.

On attaining manhood, Abraham fancied he should have a cabin of his own, and a proper helpmate. His choice fell on Mary Peat, of the Abbey Holme,

some say Mowbray, whom he married in 1735. He laboured under the delusion common enough to mankind, that the pleasures of a studious life would be enhanced by the companionship and encouragement of his spouse; but the cup of anticipated bliss was soon dashed from his lips, and he had much reason to adopt the sentiments of the poet who wrote:—

> "For 'tis in vain to think to guess
> At women by appearances,
>
> . . . . .
>
> And daub their tempers o'er with washes
> As artificial as their faces."

It soon became evident that Mary of "the Holme" had as little regard for "buiks and larning" as "Joe and Betty Fletcher"—the old folk at home; hence arose much disputation and wrangling. Abraham, unfortunately, after the noose had been tied, wished to stipulate for some portion of the night to pursue his mathematical studies; but Mary demurred, and, like most wilful women, could not be gainsayed by any appeal or argument made to her better sense of obedience and duty to her husband.

His laborious days at pipe-making, and economic management, at length enabled Abraham to build himself a dwelling-house, with two rooms on the ground-floor and space above for a loft, or, if he chose, upper rooms. Over the porched entrance he inscribed his own and Mary's initials, and the date 1739. This porch deserves special notice, as it served a purpose little dreamt of in the design, that purpose being no other than a place of shelter for the master of the house, liable to the provocation and threats of his unamiable spouse. Allowing sufficient head-room for

access to his dwelling, he boarded the upper part of the porch, by which he got a very diminutive room, seven feet by five on the floor, but rapidly tapering to the angular roof, so that he could only occupy it by sitting on a low stool, or on the floor itself. This pyramidal-shaped box was his study and *sanctum*, access to which was obtained by a trap-door. He is said to have climbed up a short rope-ladder, drawing it after him, for security from any interruption; and there he spent many hours of the night, burning his farthing-dip and conning over his Euclid. This was done by stealth, whilst Mary slept and snored. The air of his nest, for though over the porch it could not be called a parvise, much less a paradise, must have been impure, and his bodily position very constrained; but any port in a storm, and the physical menace and rabid vociferation of his wife constituted a storm in all verity. To her noisy tongue his auditory nerves, after a time, became accustomed; but when in her high flights she lifted her clogs, he could only offer a bone and muscle resistance, that hardly sufficed to contend against the use of missiles wielded by a strong arm. Few men in their study of natural philosophy had the opportunity of becoming more practically acquainted with the force of projectiles than poor Abraham in his own person, when subjected to the aim of the virago of his household.

It would have been difficult to imagine such an example of dogged determination to overcome the most pressing obstacles, as that presented by poor Abraham, cribbed, cabined, and confined within a less space than a small hen-roost, yet rejoicing in the isolation that gave him the opportunity of studying

the higher mathematics.* Neither the crude pre-Raphaelite sketches handed down to us of the mediæval alchemist puffing and blowing amid his furnaces and alembics, nor the finished pictures by Rembrandt depicting the bearded philosopher absorbed in the perusal of the metaphysical lore of the Fathers, afford anything so striking in type and originality, as that illustrated by Abraham Fletcher holding a slate on his knees and a pencil in hand, whilst crouched on the floor of his den, the darkness of which was rendered visible by a tallow-dip hanging by its own grease against the sloping ridges of the porch. Adrian Van Ostade, who exhibited such profound knowledge of chiaroscuro, and Jan Steen, who

* The Christian world is told that marriages are made in heaven. On the other hand, looking to the general experience of mankind, and especially of doctors, to the divorce and police courts, &c., there are some persons wicked enough to hint the probability of many unions being arranged in another place proverbially known as paved with good intentions. Be this as it may, ill-concerted marriages have not been without their advantages; indeed, it is curious to note how much the world has benefited by men of parts being linked to disagreeable wives, and seeking solace to their feelings in the paths of literature and science. Had the wife of Walter Scott been less petulant and more genial, the Waverley Novels might never have seen the light of day. To the same marital indifference on the part of their spouses we owe some of Milton's noble works, and not a few of Lord Byron's, Charles Dickens', and Lord Lytton's.

The following anecdote, no less true than pertinent to the subject, may be worth telling, as the experiences of one who forged the hymeneal fetters for many hundreds of young people, who, in days gone by, resorted to Gretna Green as a convenient mode of getting married. A neighbour of the old blacksmith addressed the so-called Parson,—"Well, Tammy, ye've had a busy time of late,"—it was Whitsuntide, when scores of farm-servants got "spliced,"—"but ye're aye *doing*." "True," replied old Tammy, "there's been a gey lot of couples o' late; ye talk o' the *doing*, but oh! man, if I nobbit had the *undoing* o' them, I wad hae ten times as much wark, and earn far bigger fees."

revelled in humour and invention, would have found scope and verge enough for their renowned art in trying to illuminate the physiognomy of the modern geometrician in his dark chamber; and it is doubtful if the highest efforts of their genius could have given us a portraiture of the Broughton enthusiast that would have embodied all the accessories of his position.

Abraham affirmed that he taught himself mathematics, and that all his knowledge of geometry was obtained in his "sma' garret" above the porch. If so, it may safely be inferred, that from the days of the Alexandrian philosopher, down to the advent of the present able Astronomer-Royal, Sir G. B. Airy, no man can have studied geometry under such untoward circumstances. What a love of learning, and what marvellous powers of application he must have possessed, when night after night he would retire to his dingy cell, physically cramped, yet mentally free to work his way through studies that had engaged the majestic mind of Sir Isaac Newton.

Abraham's mental experiences recall those of Palissy. The progress of the potter's art, that in time came to embellish the tables of the rich with ware of exquisite form and finish, yielding fame and profit to the designer, was nothing in the eyes of his wife, who thought only of filling her cupboard with present requisites; and the aim of Fletcher, to be able to live by an intellectual calling rather than by manual labour, appeared to his home comforter little better than a phantom of the brain or will-o'-the-wisp. Palaver, as she construed Abraham's scholarship, would not fill their mouths or cover the bairns' backs. Books cost money, and were only for "quality folk,"

who had nothing to do to fill up their time. Pipe-making did not yield riches when closely followed, and "broken time," caused by poring over books, would be ruinous. How often, as well as daily, had Abraham to listen to this kind of preaching, and the preaching of a woman in hot temper is said to be as seething as burning coals. When the worst comes to the worst, things are said to mend; and so after a few years of wrangling Mary fancied there was something in scholarship, and that her husband might do well to take the position of a village schoolmaster.

Before parting with Abraham as a pipe-maker, let me say that tradition gives him the credit of being a first-class workman, and a good salesman of his wares in the market towns. In the history of his art, from the fashioning of bamboos into pipes, that gratified the coquettish fancies of the Spanish señora, as well as the phlegmatic Dutch boor, down to the process of baking clay adopted by John Bull, who dearly loves his "cutty" or "churchwarden," and pint of home-brewed, it would be difficult to find any individual who followed the craft possessing the mathematical powers and breadth of character displayed by Abraham Fletcher, the famed pipe-maker of Little Broughton.

SCHOOLMASTER AND AUTHOR.

The date of his commencing the part of dominie is not known, but he would probably be thirty years of age, and in his prime for the new avocation that called his mathematics into practical use. His abilities and desire to promote the welfare of his scholars seem to have been recognised far beyond the circle of

the two Broughtons, and, at the same time, to have enlarged his popularity. His mind, no less original than fertile, developed much that was new in the way of teaching, and like a methodical person aiming at improvement, he put his problems on record. These records, in the course of time, assumed considerable magnitude; and as they appeared to the author more practical than those found in the works accessible to him, he determined to publish the results of his cogitations. Such an undertaking would have cowed most men. He knew nothing of the printer's art; moreover, the publishing of any kind of work was quite an exceptional thing in Cumberland, and it is more than probable that no volume on mathematics had ever been issued from the press of Whitehaven till the year 1752, when "The Universal Measurer," by "A. Fletcher, *philomath*," was offered to the public. "The Universal Measurer" is a big duodecimo volume, consisting of 564 pages, and embraces every description of solid and superficial measurement, with suitable illustrations.

Fletcher divided his volume into two parts. The first part "*contains the theory of measuring, in projecting and dividing the forms of superficial and solid figures;* the second part "*teacheth the practice of measuring in all its various uses, whether artificer's work, gauging, surveying, or mining.*" His preface is explanatory of the principal articles contained in his work; and in his "twelfthly," he shows why on original grounds he "presumed to call his book *Universal*, and was once minded to demonstrate no other way for measuring but this only." Again, he says, "I might here point out several new articles, but

though I have seen all books of this kind that ever I could hear of, yet there may be some which I have not seen. I presume the reader will find this book better stored both with theory and practice, and that in more general terms than any yet extant. . . . And as no author hitherto has thought fit to lay down this method in one and the same book, I hope that may be a sufficient apology for my undertaking."

After ten years, namely in 1762, a second edition of his work appeared, entitled, "The Universal Measurer and Mechanic, in Three Parts; a work equally useful to the Gentleman, Tradesman, and Mechanic, with eleven neat Copper Plates: by A. Fletcher, *philomath.*" (London: J. Richardson.) This octavo contains 490 pages, and its general contents are summed up as follows:—

PART FIRST.

Of practical geometry, showing how to construct, reduce, divide, inscribe, circumscribe, &c., figures in plane and solid geometry; plane trigonometry, wrought geometrically, arithmetically, and instrumentally; heights and distances; levelling; surveying of mines; with a great many practical problems.

PART SECOND.

The theory of geometry, mensurations, conic sections, and mechanics, demonstrated in an easy, new, and universal method, independent of fluxions. To which are prefixed the elements of algebra, infinite series, progressions, summing of series, logarithms, &c.

PART THIRD.

Decimals, feet and inches, sliding rules, mensurations of planes and solids of all kinds, both by the pen and sliding rule; surveying, plotting, and dividing of lands; gauging, inching, ullaging, &c.; with a large and curious collection of questions

and solutions relating to measuring, gauging, mechanics, as pendulums, pumps, barometers, mills, engines, wheel-carriages, strength of walls, beams, &c.; gunnery; circular motion, proving the true figure of the earth, &c.

In his preface he speaks of the favourable reception his work had met with, and concludes by saying, "I have been careful to omit no article that seemed useful or necessary, and as cautious to avoid things perplexing or superfluous; and to make the whole more familiar and easy to the learner, I have kept as much as possible within the limits of algebra, although by this work may be acquired a clear and distinct notion of fluxions and fluents."

In the midst of 500 dry-as-dust pages—algebraic forms must necessarily be so to all but the master mind—Fletcher now and then introduced a stanza of rhyme; thus Question 38 is—

"A whin, a thorn, a sheaf of corn,
Each to be measured are;
Come, let us mind, if we can find,
A rule such things to clear."

And Question 40 is equally practical—

"A cylinder, it's said, there is to be made,
To take the least wood that can be;
Pray let us see what dimensions must be,
To hold a gallon of brandy."

On the page before the preface of this volume is the following advertisement:—"The Author is now preparing for the press a 'Treatise on Optics,' wherein will be shown the properties of light, with its reflections, refractions, heat, cold, colours, microscopes, telescopes, burning-glasses, multiplying-glasses, magic lanterns, &c., with considerable improvements. The

whole illustrated with copperplates. It will be published as soon as the success of the present undertaking is determined." And immediately beneath is his school advertisement—"Broughton, December 1761. The author continues as usual to teach all the branches of the mathematics, according to the best and latest improvements."

Looking upon the history of the man in all its bearings, and these were mainly adverse, "The Universal Measurer" of Fletcher's may be viewed as a work of no small merit, nay, considering the circumstances attendant on its publication, perhaps without a parallel in the century of its birth. And this is said with due regard to his contemporaries in the same groove of thought, men to whom Fletcher bore more or less affinity in character, namely, Thomas Simpson, the Leicestershire weaver, and William Emerson, the mechanic and schoolmaster of Hurworth, near Darlington, both of whom astonished the literary world by the issue of a long series of mathematical works. Fletcher and Emerson were very differently placed in point of birth and social position. The study of the data upon which arithmetic is founded would seem as little impulsive, both in character and tendency, as any known pursuit, nevertheless both Simpson and Fletcher derived their first breath of educational fervour from the dry pages of Cocker; and never drew rein till they mastered the higher mathematics. Both the weaver and the pipe-maker were apprenticed to their fathers' trade, and underwent nearly similar discouragement at home. When Simpson could drive his own shuttle, he migrated to Nuneaton and Derby, where city

life and libraries encouraged him to follow the united avocations of weaver and schoolmaster; and from thence he went to London, the true field for a man of genius, where he shone far above all his compeers in mathematics. Fletcher kept by the home-ingle of Broughton to his great loss, and as his literary efforts were checked by the intellectual poverty of provincial life, he took to natural science and the doctoring of the lieges. As they resembled each other in combining their trade and schoolmastering, so they were both prone to astrology; and Simpson duly practised it to his pecuniary advantage. Fletcher, with his *threepenny* portion of tuition, required long years of self-education and probationary study to attain the vantage-ground possessed by Emerson in his early boyhood, seeing that Emerson was the son of a teaching mathematician, and not less specially favoured by a classical education within his father's household. Fletcher had to live by daily toil; Emerson enjoyed a competence, could travel to London, and shut himself up there with his printer's proofs, and devote his whole attention to his "Method of Increments" and "Doctrine of Fluxions." Fletcher had a virago for wife, and a large family; Emerson was childless, and his wife was content to whirl * the spinning-wheel

* The highest praise which the ancient Romans could express of a noble matron was, that she sat at home and span—"Domum mansit lanam fecit;" and the same views held good in England at the dawn of the present century. Lord Byron suggested the Bible and a cookery book as the proper study of women. Now his notions of human nature hardly fitted with the biblical; and when dining with Rogers, his brother poet, he showed no appreciation of the more highly-prized cookery.

supplied to her by the mechanical ingenuity of her occasionally truant husband.

My late estimable friend Mr Joseph Coulthard, master of Croft House Academy, Brampton, a self-taught man of real ability, who had given much attention to mathematical subjects, used to say that Abraham Fletcher's "Universal Measurer" was an extraordinary volume, and evidently the quarry from which Hutton and Bonnycastle had drawn a portion of the building materials entering into the formation of their valuable works.

My friend Dr W. O. Lonie, of Madras College, St Andrews, a mathematician of no mean authority, writes, "My dear sir,—I thank you heartily for the opportunity of looking over Fletcher's wonderful book; a number of his geometric problems are solved empirically, *id est* approximately, as was usual in those days when the utilities of mathematics were more sought after than any rigid theories. His algebra, on the other hand, being evidently his *forte*, must have been a *chef-d'œuvre* in its day. His work on 'Converging Series' is in many respects quite up to the present day. I have met with nothing which will surpass the elegance of his demonstration of the summation, &c., of series by differences in Problem 171, whence, doubtless, Bonnycastle and others have since derived theirs. His series for computing logarithmic tables, as deduced from a wonderful Semma in Problem 174, is a very striking example of his wonderful powers; but the series themselves are, for practical purposes, now superseded by Professor James Thomson's and others. In a series for solving equations he follows Sir Isaac Newton, or rather

deduces Newton's formulæ by an apparently original investigation. His treatment of reversion of series has, as far as I am aware, never been carried farther; and though several other of his series, such as those for the areas and solidities of curved space, have since been superseded by the extension of the calculus, they are none the less masterpieces of skill and power."

Mr Isaac Todhunter, F.R.S., so well known to the mathematical world, writes more cautiously regarding the original matter in "The Measurer." It is only right to mention, however, that his engagements prevented his looking at the book "very closely;" and whilst admitting that Fletcher's examples and illustrations may be new, he thinks that "it would be difficult to settle this point without a careful comparison between the volume and the works of other writers" of the period. Now Fletcher's opportunities of consulting mathematical works must have been of the most limited kind possible, the communication with London being attended with such contingencies, that no man of means in Cumberland, even so late as the year 1800, ventured so far without first making his will. Mr Todhunter says—"There may have been great merit in the production of such a work, but this would of course depend on the circumstances in which the author was placed." The readers of the preceding pages of this memoir know what these circumstances were, and will appreciate the justly expressed opinion of so careful a writer as Mr Todhunter. Other authorities need not be cited.

It would be interesting to know the extent of the issue of his first edition of "The Universal Measurer," and where it found purchasers, when there was so

little intercourse between the west of Cumberland and the more populous districts of England, and when schoolmasters able to peruse the mathematics of Fletcher were few and far between. My curiosity has been most moved regarding his advertised "Treatise on Optics," of which I can learn nothing, directly or indirectly, in the great libraries of London, Oxford, Cambridge, or Edinburgh; and with the exception of the British Museum, which contains both editions, neither the Bodleian nor the other institutions just referred to contain a copy of his "Measurer." If his enthusiasm for publishing met with a check to his proposed work on optics, there were other channels open to him for the exercise of his energies along with his daily schoolmastering, and the first apparently that took possession of his thoughts was botany. This, again, was but a step to a higher grade in science, involving a study of the medical art, the theoretical initiation of which was probably derived from the writings of the herbalists.

DOCTORING.

Whether the paucity of doctors, or the earnest solicitations of friends wishing to have his advice on their physical ailments as well as on other matters, or the natural bent of the man himself to test the qualities of plants, or all united, called him into the field of medical practice, is not so clearly determined. There was much to encourage his new venture in the growing confidence reposed in his skill, and the anticipation of realising as ample a remuneration from doctoring as schoolmastering; and, more than all, the pursuit itself had considerable attractions to a

man of superior intelligence and character. His known tendency to gather herbs was very much in his favour, as the great bulk of the rural population then, as now, placed more faith in the curative influences of native plants than in the whole of the British pharmacopeia. Moreover, they had greater confidence in empirics than in the regular profession. A classical and mathematical education, collegiate training, many years' probationary study of medicine and the collateral sciences, and the possession of diplomas, are of no avail in the eyes of a discerning public compared with the dogmatic asseveration of an out-and-out quack resting his claims on a knowledge of herbs. Abraham could have no pretensions to pharmacy or botany, for as a science botany was then unknown in England, and only trying to get heard in Sweden through the exertions of Linnæus; but was eager to distinguish the common plants of his neighbourhood and their virtues, so that he might apply "native growths to native diseases," and so act in accordance with the general sentiment of his day. Much value was also attached to astrological phenomena as a guidance to the culling of plants; hence Abraham's nocturnal strolls in the lanes were held of significance, and tended to enhance his reputation.

Perhaps the most striking fact in the popular favour that shone on "Dr Fletcher" was to be found in his domicile, that resembled an old curiosity-shop in its medical aspects. His kitchen was a very motley—bundles of herbs hanging from the *balks* alongside flitches of bacon, frying-pan, and iron girdle; simmering decoctions on the hob; and on the dresser a wooden bowl of pills (Fletcher's potents),

stuffed birds, skeleton forms, and bottles containing worms, thus proving incontestably the value of Fletcher's propulsives;* mathematical and astronomical diagrams graced the walls, looking like cabalistic signs to the clownish multitude. All these paraphernalia duly impressed the bucolic mind with the belief that Abraham was rich in learning and medical attributes. His personal appearance, methods of address, and highly knowing character, helped to foster the credulity of the bystanders.† Nothing captivates the vulgar

* The uneducated classes are not the only credulous people in the world on matters pertaining to physic. In the year 1834 "a worm doctor" had a stall in the Carlisle market-place, on which were arranged lots of bottles containing various species of worms professedly of human origin, and alongside these disgusting animals stood mixtures and powders, noted propulsives and vermifuges. The ragamuffin vendor announced his wonderful cures, and, to give zest to his oratorical flourishes, defied the rank and file of doctors to compete with him and his infallible nostrums. And who should patronise these but a High Church dignitary? Watching his opportunity, when there was a lull in the market-place, the learned prebendary crossed from the corner of the old Guardhouse to the worm-stall, and looked with keen eyes on the array of parasitic forms; then pointing to one particular bottle, as if the worm contained therein resembled the species infesting the theological gut, made a purchase of the "never-failing" worm-drops, and rather sheepishly retired homewards.

I had been taught in my youth that the Abbey of Carlisle was sacred to wisdom and learning, and that the cozy stalls of the cathedral were the honoured rewards of scholarship and piety; but after witnessing the rev. canon's patronage of a low itinerant quack, I began to question the sagacity of the doctors of divinity, and not less to wish that the fleshpots of the State Church were better bestowed than in fattening prebendaries for parasitic paradises.

† A portrait of Abraham at home, amid the stagey surroundings of his art, feeling the pulse and scrutinising the physiognomy of his patients, might have constituted a companion picture in quaintness to the famous one painted in 1773 by Monsieur Le Prince, painter to Louis XV., and admirably engraved by Helman, entitled "*Le Medécin Clairvoyant.*"

mind so readily as show, particularly the show of a man's craft when mystery hangs around it; even the semblance of mystery has an alluring influence upon men and women of weak fancies, and of this class, as Carlyle would say, our thirty millions are mainly composed.

Abraham's talents were not hidden under a bushel; his fame spread far and wide—a modern Galen in reputation. The people dubbed him "Doctor Fletcher," and he was not disinclined to make his claims good as one of the medical fraternity, though on an irregular footing as to qualification. In a letter bearing date May 16, 1772, addressed to Dr Gill of Antigua, by his classical uncle Isaac Fletcher of Underwood (no relation of Abraham's, but the ancestor of the Tarn-Bank Fletchers), is the following:—"Dr Abraham Fletcher is still in very great repute, and, I believe, he gets much more business than any of the regular physicians." The knowing Abraham must have laughed in his sleeve at the credulity of his patrons, for he, of all others, was likely to have anticipated Sam Johnson's definition of physic being the art of amusing the patient whilst nature cures the disease. Being well aware of the favourable feeling out of doors, he only required to exercise his wits to continue in possession of the faith and trust of his patients.* Though no doctor in the strict sense of

* Here is one of Fletcher's prescriptions—"Decoction of herbs. Six ounces of nettles, six ounces of mugwort, five ounces of tansy, five ounces of balm, four ounces of pennyroyal. Boil all these slowly in two quarts of water down to one; cover it till cold, then strain the herbs hard out, and boil the liquid with three ounces of lump sugar. When cold, put in half a pint of brandy, and keep it in a bottle closely corked. A wine-glassful to be taken night and morning.—Abraham Fletcher."

the term, he was greatly superior to the herbalist class of practitioners; moreover, he evinced no small acumen and ability in manœuvring others. He got the credit of having tested the efficacy of the plants he prescribed, and fairly belonged to the empirical school that is generally held in favour by the non-rationalistic class, who prefer dogmas in physic, and are no less prone to cherish the dogmas of politics and divinity.

It is recorded of Abraham, that when a patient came to consult him, he retired to an adjoining room and listened to his wife's interrogation of the invalid, so as to enable him to form his diagnosis; then stepping forward, he would look intently at the patient's face, and tell him his complaint without asking a question. No more artful course could have been devised to secure a sick man's confidence—the intuitive diagnosis of disease being indicative of true genius that makes the prognosis and treatment assume the semblance of certainty. With the view of testing Abraham's skill apart from his wife's aid, a young fellow, in concert with his comrades, feigned disease, went to bed, and sent for Fletcher. The following dialogue is said to have taken place:—

Doctor. "Well, what's the matter with you?"

Patient. "Very ill;" at the same time suiting his voice and countenance to his "woful condition."

Doctor. "Give me your arm. Where's the pain principally?"

Patient. "In my head, sir. I fear I am going to have another attack of the brain-fever."

The doctor began to see through the trick, and, with a most provoking gravity, said, "Be calm, I

entreat you, my lad, you need not apprehend brain-fever, the thing's impossible, you have got no brains to attack; and considering that you have so recently been cured of the itch, your health is as good as could be expected." The burst of laughter from the patient's comrades behind the bed convinced the doctor that he had hit the nail on the head. No one repeated the experiment; but it naturally became known that the doctor had achieved a triumph in his art that added fresh laurels to his brow.

Fletcher owed his success as a doctor to his being looked upon as a local genius, to his knowledge of the people's habits, his avoidance of the heroic treatment, and his trusting in the majority of instances to Dame Nature's own operations. The bitters he administered created an appetite; his pills gave freedom to certain channels; his lotions, conjoined with rest, subdued local inflammation; he bled gross habits and blistered old achings, and by humouring the whims of his patients, did a large amount of good. He appears to have taken regular professional rounds, and to great distances, as far as Carlisle, it has been said, and these peripatetic services filled up many a long day of summer, affording him, at the same time, fine subjects for graphic story-telling in the winter evenings.

ASTROLOGER.

In his study of herbalistic lore Fletcher had come across

> "Many rare pithy saws concerning
> The worth of astrologic learning,"

and his curiosity was excited to fathom the grand

mysteries of a science that had engaged the learned of all ages, and still lingered in Europe as the last remnant of the Chaldee philosophy. Being mathematician, herbalist, and doctor, the gradation to astrology was easy enough; his exact science could help him to a knowledge of the planetary orbits, whilst his natural history studies gave a clue to the supposed interference of the celestial influences.

> "He had been long t'wards mathematics,
> Optics, philosophy, and statics,
> Magic, horoscopy, astrology,
> And was old dog at physiology."

He loved the abstruse and mysterious, and if he believed in "judicial astrology," as some aver, the fact would imply a weakness in his character that was by no means rarely exemplified in his day among others, and men, too, of great acquirements. A belief in astrology was not consistent with his logical acumen, but he might take advantage of the prevailing sentiment that the planets exercised a propitiatory influence on the earth's crust, and so lead his admiring friends to infer that his medical success depended on his knowledge of the celestial orbs, as well as his more direct scrutiny of the marvellous organism of man himself. Whether rightly or wrongly, Fletcher got the credit of being able to read the fortunes of humanity in the stars, and to be able to prognosticate good or evil from solar and lunar observations. In conversing on the mysteries of nature, he seemed to his bucolic neighbours to pass from things visible to things occult, from the human sphere of observation to the darker destinies, so that doubts were whispered

as to his having uncanny dealings with a very uncanny and nameless personage.

Though the burning of witches was no longer heard of, the belief in witchcraft was prevalent in Fletcher's time, and cannot be said to have entirely disappeared in Victoria's reign. In the eyes of the vulgar multitude, the curious books, and still more curious symbols, algebraic and astrological, that the Broughton philosopher was wont to pore over, led to the notion that he was "possessed;" and this, taken in conjunction with his success in physic, may account for his being called the Wizard Doctor. The notion that he was in league with "Old Scratchum," was not strictly confined to the colliers and their congeners in ignorance. Into the feelings of such crude and superstitious individuals, he could enter with fun and good humour, though he never relished the imputations of being like him who

> "Had read Dee's prefaces before
> The Devil and Euclid o'er and o'er;"

but he had no patience with a similar folly and imbecility being manifested by not a few of the landowning and educated classes.

When a lady of position came to consult him as to the hidden future, her hopes of marriage, and its usual concomitants—much in the nineteenth century style of the fast and fashionables on a Derby day getting their fortunes told by one of those hybrid or Cockney gipsies who frequent the Downs—he expressed his great surprise that she should follow the ignorant and superstitious herd, when so much better sense was expected of her.

He could use a rough tongue when the occasion

tempted. Thus, the wife of a sailor who had been unheard of for two years wanted Abraham's opinion as to his life or death; if the latter had occurred, she would marry a second husband. His reply was—"He is gone to the devil long ago, you ——; you had better follow him." The woman, glad of an excuse, did marry, and soon afterwards her first husband appeared on the scene; but how the contending parties fared in such a dilemma is not known.

In another instance he paid the offending party off in her own coin, and as an historical feature of the times, dating back about 100 years, it is worth relating. Mrs D., of D——, had lost a washing of clothes, and sent for the Wizard Doctor to come over and help her to discover the thief; but he, knowing her business, declined. Next day the lady herself drove up in her carriage to Broughton, and sought an interview with Abraham, whose grotesque appearance, in the midst of his fantastic surroundings, seemed to stamp his wizard character. She told her loss, and hoped that on the strength of his knowledge and "other connections" (a highly delicate allusion to old Cloven-foot), he would name the rascals who had run off with her "month's washing." Upon hearing all this, Abraham, who was now getting asthmatic, and who gloried in a joke where "old Hornie" played first fiddle, dryly observed that he had given up all dealings with the Devil; "for," continued he, after another fit of vehement coughing, "the last time I summoned him here he smelt so horribly of brimstone, that I was nearly suffocated before we got our business thoroughly transacted." This was enough for Mrs D., who made a speedy exit, and hardly recovered

her composure till she found herself in her ancestral hall, at a respectable distance from the professed or occasional habitat of his Satanic Majesty.

Abraham has been described to me, by one who knew him, as a handsome man of middle stature, rather "thin visaged, and an eye with a vast o' sense in it." He seems to have been of a nervous, sanguine temperament, of wiry frame, and the most active habits. He talked very fast, and very emphatically —"always to the point, and no waste of words." This peculiar rapid mode of talking is marked to-day in the descendants of his brothers' families, even to the third generation. He was the life of the village, and probably of the district, having a word for everybody, hearty and gossiping, prone to jest, and a capital story-teller. Never taken aback by any questioning, he always had his answer ready—"aye as sharp as a needle in catching folk." Excelling in everything he undertook, he possessed as high credit in West Cumberland as Abraham of old could possibly have had among his people. Nothing could be done of import in the parish without consulting him. He was a very Pope in authority, yet without a church; for neither the meetings of the non-baptized Friends, nor the baptized *par excellence*, attracted the noted man of the Broughtons. Some have clothed him in a blue daffel suit, with waistcoat long and furnished with big pockets, in which he usually had his hands when walking; others say he wore a light-grey one—the summer and winter garbs probably. The doctor in his long coat, seated on a short-legged pony, were the best known living things within a large radius of Cockermouth. Clocks were scarce,

and watches scarcer, in his times, so that Abraham's timepiece was a great fact in the neighbourhood. When a booby stopped him to know the time of day, he would hold out his watch, and remark, "See for thee sel." Too often the questioners could not read the dial, but as the geometrician used to say, "So much the worse for ignorance; everybody should learn figures."

Mary's character* does not appear pleasantly in the preceding pages. She was a loud talker, and smoked tobacco like a man; and when disposed to be unusually noisy with

"A clapper-tongue would deave a miller,"

Abraham would say to her, with the view of stopping her garrulity, "Put t' other end o' t' pipe in thy mouth, Mary." Thus they "nobbit got on middlin' together;" and when his neighbours spoke about his wife, Abraham was apt to remark that "nought good ever came over Mowbray beck"—the small stream bounding the Abbey Holme on the side towards Broughton.

"Dr Fletcher" was a shrewd observer of men and manners, and his clear and rapid discernment of character placed him on vantage-ground amid the most educated of his associates. His keen perception fitted him for the practice of physic, and the distinction of real ailments from the fanciful thoughts of his patients. But in every walk of life he was able to take a leading part. He could make tobacco-pipes and mend

* Dawson of Sedbergh, a self-taught man like Fletcher, and one of the best mathematicians and teachers of his age, was similarly circumstanced with a wife, who, instead of appreciating one of the cleverest of men in Yorkshire, used to call him a fool for his learning.

ploughs, break boys into discipline and horses into safe gear; he could issue original works on geometry, heal the sick, and "cast the divinities." What further qualifications were required to bespeak for him the character of a "universal genius," fit to hold his own against all comers?

His biography, however imperfectly told, is fraught with interest. Born in a poor village, where the shuttle, the mould, and the spade constituted the service of a small community with whom the art of gaining food and clothing was the be-all and end-all of life; without instruction or home-cheering influences, or any external aid whatsoever, he nevertheless rose by his own indomitable pluck from the paths of bucolic ignorance to the position of a man of mark, bearing comparison with the more favoured of his mathematical compeers. In his attempts to acquire knowledge he passed through a fearful ordeal; for, as a former page reveals, he was opposed in every conceivable way, as if his parents, and subsequently his wife, wished to beat the very soul out of him.

What tenacity of purpose, and what force of will, does the story of his life reveal! The great cause of his success, as he often said, rested on the fact of his "*never being idle.*" Perseverance was his motto, as it was in John Dalton's instance; and both these remarkable men were born but three miles apart on the opposite banks of the Derwent, and breathed the same keen mountain air of Cumberland that may have helped the growth of their intellectual thews and sinews. Everything that Fletcher and Dalton undertook must be mastered, and without delay. There was no shrinking from duty on their part, however

frowning and arduous the path might be; and as they aimed at a high standard of excellence, they laboured right earnestly to attain it, and by dint of real work eventually achieved a true greatness deserving honourable record.

Mechanical arts, the teaching of mathematics, the practice of medicine, the study of the physical and natural sciences, were all alike to Fletcher's comprehensive grasp. The great popularity he enjoyed in the practice of the healing art would have been flattering to any man; but his literary work—"The Universal Measurer"—proved him of far higher repute as an author, as it showed his capacity in a field only frequented by the educated mathematician. Had he been placed in different circumstances in early life, and favoured by education and training suited to his masculine and nervous energies, he would have attained the position of Senior Wrangler, or become a learned professor and a man of national repute.

After threescore and ten years, Fletcher felt the truth of the Psalmist—he was no longer able to go his long rounds, but confined his walks to his farm and home consultations. Asthma and other diseases at length drove him to bed, and his death took place on New Year's day 1793, in the 79th year of his age. He was buried in the Baptist Chapel-yard at Little Broughton,* but, I regret to add, there is no tombstone to mark the spot. Against the wall of the graveyard bounding the road leading up to Little Broughton is a simple slab to the memory of Joseph Fletcher, who

* There is a tradition that this Baptist Chapel and yard were formed by Cromwell's soldiers. Be this as it may, no one can visit the place and fail to be struck with the beauty of the vale upon which it looks, and the grandeur of the distant hills beyond.

died Jan. 27, 1769, æt. 85; and Elizabeth his wife, who died January 10, 1765, æt. 75. Now these were Abraham's parents, and most probably his remains were laid in the same grave twenty-four years afterwards. This opinion is strengthened by the fact of the old patriarch Joseph Fletcher's burial-ground being surrounded by the relatives of his family; indeed, part of his grave is covered by a raised tombstone to his youngest son David, who died in 1817.

Abraham and Mary Fletcher had issue two sons and eight daughters. The tracing of so prolific a race as the Fletchers would involve a long family history and genealogical details of no interest to my readers; moreover, I have failed to elicit any marks of hereditary genius being transmitted to Abraham's progeny. One of their sons, William, took up his father's calling, and had advanced so far in public esteem as to be called Doctor during Abraham's lifetime. Of this Dr William's progress through the world I can offer nothing trustworthy; but if he had shown his father's parts, his memory would have been as justly treasured by the Broughtonites.

Abraham's youngest brother, David, married Martha Robinson, and had nine children. The third son of this marriage, also a David, a zealous Baptist and hearty yeoman, married twice, and with the usual luck of men like the Fletchers, whose virtue it is to have their quivers full, had a patriarchal following. Of his four children by his second wife—Jane, daughter of Jeremiah Thompson of Workington—two only reached mature life, and in these two I recognise my friends, Mrs Edward Steel of Mire-End, Cockermouth, and Mr Henry Fletcher of Workington.

Doctor, *alias* Abraham Fletcher, died possessed of £4000. Part of this would be property he inherited on his father's death in 1769, but the great bulk of his fortune was the result of his own long-continued exertions; and if natural abilities of a high order, accompanied by a marvellous industry, ever merited pecuniary reward, Abraham assuredly deserved the thousands he had gathered.

WILLIAM BROWNRIGG, M.D.

"Man is the interpreter of nature."
—LORD BACON.

DR WILLIAM BROWNRIGG was born at High Close Hall, in the western division of the county of Cumberland, on March 24, 1711. Of his family connections, his early years and education, but little is known. He served an apprenticeship to a surgeon in Whitehaven preparatory to his going to London, where he studied during two sessions. He then proceeded to the University of Leyden, the most celebrated school of medicine in Europe, to which in the seventeenth and eighteenth centuries numbers of students aiming at the higher walks of professional knowledge resorted. Boerhaave, of world-wide reputation in medicine and chemistry, the anatomist Albinus, and Euler the mathematician, might well attract the cultured minds of all nations to the university they enriched by their professional erudition and example. Brownrigg obtained his doctor's degree at Leyden in 1737. His graduation thesis was "*De Praxi Medicâ ineundâ*," in which essay, according to his biographer Dr Joshua Dixon, from whom the main facts of this memoir are

borrowed, he discussed the state of the air, climate, and various contingencies affecting the locality where the physician proposes to reside; and also other hygienic and topographical details.

Dr Brownrigg having settled down in practice at Whitehaven, soon began to test his theoretical opinions by making inquiries into "the damp or exhalations arising in coal-mines;" and in this highly useful work he was well encouraged by Sir James Lowther, the proprietor of the said mines. Keeping in view his own special calling of physician, he looked upon an exploration of mines, and a knowledge of the gases found therein, as likely to solve some of the difficulties surrounding the diseases of miners, and enabling him to establish the ground of superiority possessed by some mineral waters over others in their application to therapeutics. And further, as he had been impressed with the notion that epidemic diseases were in part produced by "mineral expirations" (in other words, mephitic exhalations and effluvia), he hoped that his researches would lead to the discovery of their nature and remedies. In all these pursuits he seems to have been encouraged by motives of humanity and kindness, as well as the enlargement of the field of science.

The results of his inquiries constituted the basis of several essays, which were presented to the Royal Society of London by his patron, Sir James Lowther. These essays received "distinguished approbation," and eventually gained Brownrigg the fellowship of that learned body. In 1741 he published in a separate form what he had communicated to the Royal Society—"An Extract of an Essay on the

Uses of a Knowledge of Mineral Exhalations when applied to discover the Principles and Properties of Mineral Waters, the Nature of Burning Fountains, and the Poisonous Lakes called *Averni*."

He was treading upon ground that had attracted the notice of Pliny, who spoke of the *Spiritus Lethales* —not an inappropriate term as applied to the emanations from the recesses and depths of the earth. Nor did the inflammable and light-extinguishing gases occurring in mines and caverns, or those arising in bubbles from the marshy grounds and mineral springs, escape the attention of the alchemists towards the end of the fifteenth century; among whom none were more noted than Basil Valentine, the Benedictine monk, whose penetrating observation revealed the fact that the results of his operations in the laboratory at Erfurt were not wanting in analogy to the greater operations of nature in her hidden laboratory beneath the crust of the earth. The comparison of the character of these natural products with the educts of chemical analysis was worthy of every attention; and though Dr Brownrigg was not the first in the field of inquiry, he lent a helping hand in elucidating some interesting details forming part of the groundwork upon which Black, Cavendish, and Priestley built their noble works, which added significant lustre to the chemistry of the eighteenth century.

In his exploration of the coal mines at Whitehaven, he found the opportunity of explaining what had occupied the thoughts of the truly philosophic Robert Boyle, who had observed that some kinds of air were unfit for respiration. A contemporary of Brownrigg's, Dr Seip, had also suggested that the gas which

stagnated in some caverns near Pyrmont was the cause of the briskness or effervescence of the water.

In the year 1741 Dr Brownrigg married Mary, the daughter of Mr John Spedding of Whitehaven, steward to the Lowthers, the proprietors of the coal-mines and of much landed property in the west of Cumberland.

Probably owing to the sound indoctrination he had received from his renowned teacher Boerhaave, his chemical knowledge seems to have been considerably in advance of the times in which he lived. He erected a great laboratory in Whitehaven, and continued his investigations with marked industry. He endeavoured to trace the connection between "fire damp" and the gases escaping from the mineral waters; then the analogies of "choak or choke damp" to the processes of fermentation, as well as those mephitic or poisonous exhalations escaping from the earth in some parts of the globe. It ought to be borne in mind that the nature of these highly pernicious gases was then quite unknown, and the term "fire damp" simply referred to the explosive character of the gas escaping in mines, whilst the term "choke damp" seems to have had its origin in the suffocative influences of the gas going by that name. Though John Baptist Van Helmont, in the previous century, had attributed the phenomena of the *Grotto del Cane*, near Naples, to the presence of a gas invisible and fixed in bodies, Brownrigg seems to have arrived at tolerably correct conclusions regarding the real nature of "choke damp," or, as it is now technically called, "carbonic acid gas."

Dwelling upon this branch of chemistry, and its

importance in elucidating the character of mineral waters and their application to the treatment of disease, Brownrigg paid a visit to Spa, in Belgium, with the view of determining the degree of impregnation of its waters by gases. The result of his experiments were contained in an essay read to the Royal Society, and inserted in the fifty-fifth volume of the "Philosophical Transactions" for the year 1765, entitled, "An Experimental Inquiry concerning the Mineral and Elastic Spirit, or Air, contained in the Waters of Spa, in Germany, as well as unto the Mephitic Qualities of that Spirit." The Royal Society marked their approval of this effort by awarding Dr Brownrigg the Copley Honorary Medal for the best original publication in the course of the year 1765. This honour placed Brownrigg in the happy position of an acknowledged name in science, and induced him to promise to the Royal Society further information respecting the separation of the air of the Pouhon water, and its various properties—a promise which he fulfilled in 1774, by publishing, "A Continuation of an Experimental Inquiry concerning the Nature of the Mineral and Elastic Spirits, or Air, contained in the Pouhon Water, and other Acidulæ." This essay is to be found in the sixty-fourth volume of the "Philosophical Transactions."

At this time the Hon. Henry Cavendish and Mr Lane were working in the same groove of inquiry as Brownrigg, and it would appear that he laid claim to the discoveries in part made by these learned men, affirming that, though they were the first to publish, he was the first to explore and indicate the facts. Any discussion as to the original claims would be out

of place here; it may, however, be observed, that Cavendish was the last man to borrow his neighbour's ideas, seeing that his own were the most fertile in the field of discovery. It may be fairly ceded to Brownrigg that he did more for the analysis of the Pouhon waters than any of his predecessors, and, notwithstanding the claims of the learned Bergman (Professor at Upsal), Brownrigg will always be recognised as an active participator in the inquiries made in the eighteenth century relative to "fixed and inflammable air."

The frequency of the wars engaged in by England rendered the products of other countries, upon whom she was more or less dependent for supply, not only very dear, but almost unattainable; and of the more valuable class of products, none claimed greater attention than common salt, the manufacture of which in England was so inferior to foreign salt. Early in the last century the Government granted a premium of £10,000 to Mr Lowndes, of Cheshire, for improvements in his method of salt manufacture. In 1747 Brownrigg, looking upon the Cheshire mode as more or less imperfect, set to work with his usual vigour—that vigour enhanced by the knowledge that the health and lives of his countrymen depended on abundant supplies of the article—and invented other processes cheaper and better than those of Mr Lowndes. Without soliciting any public reward, he made known his views in a work published in 1748—"The Art of making Common Salt as now practised in most parts of the World, with General Improvements in that Art for the use of the British Dominions." In his usual way he discussed the

question of salt manufacture in all its bearings, its history at home and abroad, and his own improvements and experiments. The character of Brownrigg's work may be judged of when the Royal Society caused an abridgment to be made by Mr William Watson, which they published in the forty-sixth volume of their "Transactions;" and it obtained further honours from private individuals, teachers of chemistry, and political writers. Thus, the celebrated Professor Black of Edinburgh gave unqualified praise to the essay on salt; and Dr Campbell, in his "Political Survey of Great Britain," calls it "a very learned, ingenious, and solid performance, than which there is not perhaps anything more concise, or more correct in any language."

Dr Brownrigg was of opinion that the preparation of "bay salt" could be conducted with equal convenience and success along the sea-coast from Dover to Yarmouth as in France, Spain, and Italy. The English nation reaped the benefit of his labours, and owed him no small thanks for extending the resources of the arts, and promoting the wealth of the people at large. His essay on the manufacture of salt in 1748 was the most valuable contribution that had yet been offered to the British public in this direction; and, oddly enough, eight years later, a boy—John Christian Curwen—was born only a few miles distant from Whitehaven, who lived and, by his manful eloquence and arguments, persuaded the House of Commons to repeal the odious tax long levied on salt. England, it thus appears, owes to two Cumberland worthies the best history and mode of procuring salt in the middle of the last century, and the

great boon of having this useful condiment freed from all taxation before the expiration of the first quarter of the present century.

Cartagena, in New Spain, furnished a curious substance, to which the name of *Platina di pinto, juan blanco*, or white gold, was given. A specimen of this article was carried to Jamaica, and a Mr Charles Wood, of some skill in metallurgy, brought it to England in 1741. Dr Brownrigg being a relative of Wood's, secured the new "semi-metal," and after subjecting it to various experiments, described it as a natural ore—now known as one of the "noble metals," and designated Platinum. He presented the pure metal and some combinations of it, along with a report, to the Royal Society in 1750 (forty-sixth volume of the "Philosophical Transactions"). It seems that whilst Brownrigg was at work on the new metal, Don Antonio d'Ulloa, a Spanish mathematician, had directed attention to some of its characters in 1748. Neither the Spaniard nor the Englishman dreamt of the manifold uses to which platinum would be put in another century, and of its import in the arts and its uses in chemical manipulation. Dr Wollaston improved upon Brownrigg's methods, and the researches of MM. Deville and Delray (*Annales de Chimie et de Physique*, for August 1859) largely extended the chemical history of platinum.

Though busy in various ways, professional and scientific, Brownrigg resumed his observations on coal-pits and their gaseous products, with a view of preventing explosions and obtaining good ventilation. About the year 1755 he described the plan and workings of the Whitehaven coal-pits.

The forty-ninth volume of the "Philosophical Transactions" contains his "Thoughts on the Rev. Dr Hales' new Method of Distillation by the United Force of Air and Water." This paper was credited with having a direct application to the improvement of the steam-engine of that day.

In 1771, when the plague appeared in some parts of Europe, and the English Government, alarmed by the spread of the disease, suggested preventive measures, Dr Brownrigg, always alive to the needs of science, wrote his "Considerations on the Means of Preventing the Communication of Pestilential Contagion, and of Eradicating it in Infected Places." In this essay he showed himself a strong contagionist, and advised the strictest quarantine, and all the measures practised in other countries against the encroachment of the plague. His opinion was naturally sought by the townsfolk of Whitehaven on the breaking out of jail-fever in 1757–58, and again in 1773, when a worse state of things prevailed. In that year the malignant fever was comparatively mild at the outset, the deaths being 1 in 20, gradually increased in severity, destroying 1 in 10 and 1 in 6, and finally carried off *one-half*, or even a fraction more than a half, of the persons affected. Contrary to the ordinary experience of epidemics, the disease got worse and worse each month, and the period of its operation extended over nine months. The mortality was unaccountably great, and quite unparalleled in Britain. Either the nature of the disease was misunderstood, or Whitehaven had within itself the most poisonous atmosphere that ever pervaded a town whose history came

under the notice of medical writers. Those who are interested in the history and treatment of jail-fever as it appeared at Carlisle, where the mortality was comparatively trifling, may be referred to the fourth chapter of my "Life of Dr John Heysham" (Longmans & Co., 1870).

In 1772 Brownrigg had a high compliment paid him by receiving as visitors the famous Dr Benjamin Franklin and Sir John Pringle, President of the Royal Society of London, at his country-house, Ormathwaite, near Keswick, to which place he had retired to spend his latter days in quiet study and philosophising. Franklin's fertile mind was always at work, and at Keswick he instituted some experiments on the Lake of Derwentwater, with the view of ascertaining the effects of oil in smoothing the surface of the lake when in a state of commotion. He had been led to this by observing whilst at sea, in 1757, the comparative stillness of the waves where the greasy water, derived from culinary operations, had been thrown into the sea around the ship, and he continued to follow out the inquiry, in which he was joined by Dr Brownrigg and the Rev. Mr Farish of Carlisle. The correspondence of these learned men on this subject is to be found in the sixty-fourth volume of the "Philosophical Transactions," 1774. In the same year and same volume appears Brownrigg's letter to Sir John Pringle, describing twenty specimens of native salts found in the coal-mines near Whitehaven. These salts were inspected by Fellows of the Royal Society, and afterwards deposited in the British Museum. Brownrigg also examined the lead-mines of Borrowdale, near Keswick, and collected

various mineralogical specimens the chemical character of which he meant to describe; but, as far as I can ascertain, there is no record of the results of his labours.

Little more than a brief epitome of Dr Brownrigg's labours and researches has been attempted in this memoir; yet it should suffice to show the practical and comprehensive character of the man, and his sincere devotion to a science then but little understood. Chemistry, indeed, was everywhere trammelled by crude and undigested theories, the residuary results of alchemy, or by the dogmas of men of ambitious pretensions and false repute; hence the long and arduous steep that had to be climbed by the experimentalists and inductive philosophers of the past century.

Up to the time of Henry Cavendish, it would be difficult to find a more original chemist than Brownrigg in England. Had he planted himself in London, as he was solicited to do, instead of following the art of physic at Whitehaven, he would have reaped larger personal advantages, and done a great deal more to extend the laws of chemistry, and to show the value of these laws to commercial prosperity and the higher comforts of social life.

He was in correspondence with all the learned chemists, *e.g.*, Black, Priestley, Bergman, and not a few of the physicists of Europe. His observations on the new forms of matter, and more particularly the gaseous compounds, induced others to follow in his wake, and to realise important results.

To sum up Dr Brownrigg's character. He fulfilled the duties of citizenship in an exemplary manner,

and left a good name for charity and philanthropy. He was a chemist of true distinction, an original observer and discoverer, who will hold his claims in the history of the science he cultivated so assiduously and successfully. He was a practical physician of no mean merit, an elegant scholar, a good linguist and mathematician; and he showed great partiality for the arts and agriculture. His museum of fossils, salts, and metallic substances proved his acquaintance with the subterraneous products of Cumberland. Finally, his varied contributions to the "Philosophical Transactions" remain as a faithful record of his high rank among the chemical philosophers of the eighteenth century.

After a long trial of failing health, Dr Brownrigg died at Ormathwaite, Keswick, on January 6, 1800, aged 88 years, leaving no issue.

In Crosthwaite Church, east of the chancel, is the following inscription on a marble tablet:—

WILLIAM BROWNRIGG, M.D., F.R.S.,
A PHYSICIAN AND PHILOSOPHER,
EMINENTLY DISTINGUISHED,
DIED AT ORMATHWAITE,
JANUARY 6TH, 1800,
AGED 88 YEARS.
MARY,
HIS WIFE (DAUGHTER OF JOHN SPEDDING, WHITEHAVEN),
DIED AND WAS BURIED NEAR THIS PLACE,
FEBRUARY 17TH, 1794.

Edw. Troughton.

EDWARD TROUGHTON,

MATHEMATICAL INSTRUMENT MAKER.

"*The present state of Astronomy requires the utmost perfection in the instruments.*"—THE BISHOP OF CLOYNE.

ENGLAND has of late years become so prolific in the production of sensational novels, thin gruel theology, and other miscellaneous flummeries, that each day brings forth bantlings of some sort, to suit the fondling care of the gossipy and garrulous "Mrs Gamp," or the devout and denominational "Mrs Harris." In this fecundity of the fictional and ephemeral, history, science, and philosophy have but a faint chance of being listened to; the gauze and gossamer of literature are in the ascendant; whilst really instructive works offer but few attractions to the multitude. The cause, however much it may be regretted, is not very far to seek, inasmuch as literature is influenced in its choice of subjects in the same way as commerce is ruled by circumstances affecting the laws of demand and supply.

Whilst every one must rejoice in the high value of many English works on science, history, geography, the fine and industrial arts, those engaged in pursuits

similar to my own will probably agree with me in thinking that there is need of improvement in the biographical department of our larger histories and cyclopædias. Though biography be a little overdone in the present day, both as to the selection and much too diffusive treatment of its subjects, its recognition of the men of the past, particularly of the pioneers of industrial progress, is not what it might be. This inferiority is the more apparent on comparing English biographical works with the "Biographie Universelle" of the French. The majority of our writers show a bias in favour of the Court, the Parliament, and the Church, dwelling much on the minor events affecting these institutions, with but little heed to the progress of art, the cultivation of science, and the social condition of the people at large. The national honour is made to appear too exclusively due to the achievements of the sword or the cunning action of diplomacy; but faint consideration being allotted to the industrial resources of the country, upon which the permanent superiority of England must inevitably rest. In recounting the sayings and doings of our public men, and their oratorical *passage d'armes* in the senate, or in depicting the dash of our military and naval heroes, the historian is furnished with themes upon which to construct pages of flowing and captivating rhetoric. It is no less true, however, that the conquests daily being made in the peaceful arts, and affecting so largely the wealth and comforts of our countrymen, afford numerous topics fraught with historical interest and encouraging example.

Our national character owes much less to the ruling powers of the state than is generally conceived, and is

more truly the growth and natural outcome of our mixed race, in whom the elements of industry, fortitude, and patriotism play no insignificant a part; aided by the freedom given to the rights of labour, the laws of commercial exchange, and the greater diffusion of sound intelligence on all questions of practical interest. The triumphs achieved in the arts and sciences, so well exemplified in the grand discoveries of our chemists and physicists, and the fertile inventions of our mechanicians, accomplished by Watt, Cavendish, Young, Dalton, George Graham, Edward Troughton, Stephenson, and others, are surely as worthy of favourable mention in the national archives as the gossip of courts, the intrigues of political parties, and the so-called glories of military ascendancy. Admitting that some of our public men have had ample justice done to their memory, others less brilliant, but not less worthy, have scarcely been recognised, or not to the extent their merits demanded. These remarks are meant to apply to the one-sided historian, who places in the foreground of his canvas the gay scarlet, the official ermine, and the pompous accidents of an accident, and reserves the shady background for the sons of labour and genius, as if they were no more than the diminutive adjuncts to his professedly historical picture.

This train of thought, call it a digression, has arisen from my biographical experience, not the least visible in sketching the lives of George Graham and Edward Troughton, and my disappointment on finding so little said of these eminent men in our larger authoritative works. And they are not the only instances upon which to found complaint. In

treating of John Christian Curwen, Dr John Heysham, and John Rooke, I could discover no record whatever of their lives, and but little comment on their public services. The French show more universality in their works, and larger individual treatment; and, as was well said by Dr Samuel Johnson, "The French are excellent in this; they have a work on every subject." In offering my humble opinion on this matter, I have no wish to throw the slightest discredit on the literary staff of our great Cyclopædias, consisting of men of high repute; but rather to express my regret that the editorial programme had not been made wide enough to embrace every class of our country's benefactors. "Knight's Cyclopædia" devotes six volumes to biography, some of the subjects being treated at great length; but this large space has not sufficed the wants of those who look to the work as one of national reference.

Of late years the Royal Society, the Astronomical, and other London Societies, have done an excellent thing by recording in their Transactions biographical notices of each of their deceased members, written by those well qualified for the task, and who had personal knowledge of the subject. The late Rev. R. Sheepshanks, an able astronomer and critic, furnished the Astronomical Society* with a trustworthy sketch of his friend Edward Troughton, whose executor he was; and this memoir has afforded me valuable aid in my effort to record the chief points in Troughton's history.

The map of Cumberland has been not inaptly compared to a fossilized bear or quadruped, the

* "Memoirs of the Royal Astronomical Society," vol. ix. p. 283.

hinder extremities of which represent the south-western district of the said county. On drawing an imaginary line between Borrowdale Fells and St Bees, you get the base, whilst the apex of this somewhat triangular portion of territory abuts on Duddon Mouth—Lancashire and the Irish Sea forming its eastern and western boundaries. Towards the southern end of this district, about twenty-two miles from Whitehaven, and five miles south of Ravenglass, is the parish of Corney, consisting of upwards of 3000 acres; and a rural population, that in 1851, or 100 years after Edward Troughton's birth, amounted to only 278.

In this remote agricultural district 150 years ago, a family of the name of Troughton lived in a cottage called Park-Nook, and subsequently became possessed of "Welcome Nook," an estate in the parish of Corney. The Troughtons were artisans who in time realised their own freehold, and so appertained to the rank of "Statesmen"—a title held in as high regard by the farming class of Cumberland, as the Order of the Garter is by the old aristocracy of England. Whether the holdings of the Troughtons were great or small, the lands of Corney were not likely to flow with milk and honey, when the best tillage of that day showed no turnips or green crop, and but a scanty growth of cereals. A deep bucolicism long reigned over Corney, and its piping times of peace and serenity continued undisturbed till the introduction of railways brought the people out of their happy seclusion into the more bustling world.* It was truly the "happy

* When the men of Corney and Ulpha found their way to the great county election of the year 1831, held at Cockermouth, they were as

days o' auld langsyne" when the stalwart sons and comely daughters of Corney throve on oatmeal porridge and milk, barley scones and "Whillimer" cheese; bacon and potatoes, with an occasional slice of badly-fed beef or braxy mutton in the winter; and when they thought themselves "well donned" for kirk or market when clothed in their hodden grey of home manufacture. This contentment of mind, and the occupation that lent a relish to the plainest dietary, along with the general habits of the people, were so conducive to health and longevity, that numbers of them attained the age of ninety years; and not a few were credited with having passed beyond the centenary of their birth.

The Corney Arcadia did not satisfy all the Troughtons; one of them, Edward by name, had the spirit to move to London, and there became a mathematical instrument maker; and his success affected the Cumbrian home circle, then presided over by another brother, Francis, a shoemaker, who in the latter part of his life was the owner of Welcome Nook. This Francis Troughton had a daughter and three sons; the oldest and second of whom joined their uncle

greatly surprised at the different kinds of conveyances in use, as others have been at the first sight of the locomotive engine. To see the post-chaises, "queer trundling kists on't roads," repaid these old-fashioned yeomen for all the trouble of their journey. (See my "Life of William Blamire," vol. i. p. 252 of this series.)

The locomotive was the subject of many a nine days' wonder. A woman on Stanwix Bank, Carlisle, looking at the rapid moving trains on the Newcastle and Carlisle Railway, exclaimed—"Lor' bless us; the works of God are wonderful, but the works of man far cap aw" (surpass everything). Such ignorance is dreadful to contemplate, especially when manifested by persons living under the shadow of Carlisle Cathedral.

Edward in his London business: the third son was kept at home, for a time at least, to follow the handicraft, or bucolic steps of his father.

This third son, named after his uncle, Edward Troughton, was born, it is believed, at Park-Nook, or Welcome Nook, in the parish of Corney, Cumberland, in the month of October 1753; and his life and work in the world will form the subject of this memoir.

Of Edward Troughton's educational training nothing is known; but it may be inferred that he was sent to the village school, where sufficient information could be had for a lad who was brought up to manual labour. He worked regularly at farm-service till about the age of seventeen, when, according to the Rev. R. Sheepshanks, "the death of his preceding brother altered Edward's destination, and he was placed with his brother John, then a chamber-master, employed chiefly in dividing and engraving for the trade and the higher branches of the art. Under the instruction of his brother, who was an excellent workman, Troughton made most rapid progress, and at the expiration of his time was admitted as a partner. About 1782 the Troughtons established themselves in Fleet Street, where they commenced an independent business as successors to a series of well-known artists (Wright, and subsequently Cole), who had previously occupied the same premises. Ramsden was then in the zenith of his reputation, but his dilatory habits were little suited to the wants and impatience of astronomers; and this, and their own intrinsic merits, speedily advanced the brothers in their profession, and in the estimation of competent judges. Considerable rivalry ensued, and Edward Troughton,

who felt his own powers, was not a person to conceal his feelings or to propitiate an adversary. After the death of his brother John, Edward alone continued the business, latterly at a loss rather than a profit, till 1826, when his increasing age and dislike to routine employment induced him to take Mr William Simms as his partner and successor.

"The life of an artist is generally only the history of his works, and this is peculiarly true of Mr Troughton. Of him it may be said with truth, that he improved every instrument he touched, and that every astronomical instrument was in its turn the subject of his attention. In this department of art he has perhaps no equal, except the celebrated Graham, the object of his unbounded admiration. To describe all his improvements or inventions would require a detailed account of almost every instrument, astronomical, nautical, or geodesical, in actual use; and we must therefore limit this notice to a brief and imperfect summary.

"The instruments which facilitate navigation were peculiarly objects of interest to Mr Troughton; and long after his infirmities were an effectual bar to the applications of his most esteemed friends, he exerted himself to supply the seamen with well-adjusted and accurate sextants. '*Your* fancies,' he would say, 'may wait; *their* necessities cannot.' In 1788 he took out a patent for the double-framed sextant, a construction which, combining firmness and lightness, admits of a considerable radius in this invaluable instrument. In the adjustments of his sextants, and in the selection of their mirrors and glasses, he was most careful, and for many years scarcely any

other were seen in the hands of the scientific navigators of our own or foreign navies. But there is a fault in the construction of the sextant, which the maker can only imperfectly guard against—that of a sensible eccentricity: and the detection and correction of this, if it remains constant, is beyond the skill of ordinary observers. After trying and rejecting the repeating reflecting circle of Borda, Mr Troughton (1796) hit upon one of his happiest constructions, the British reflecting circle, as he delighted to call it—an instrument which, in right hands, is capable of wonderful accuracy. The additional weight of the circle, and the increased number of readings, have hitherto prevented its introduction into common use; and perhaps at *sea*, where the unavoidable errors of observation are of as large an order as those of a good sextant, the superior accuracy of the circle may not repay the extra trouble; but for observation on shore, and with a stand, no sensible observer can hesitate between the instruments. It is a characteristic trait of Mr Troughton, that, in order to bring his favourite circle into general use, he reduced its price far below the usual profits of trade; and if he had succeeded in his attempt he might have been ruined by his success, for his sextants were by much the most gainful articles of his business. With the same earnestness to promote navigation, he invented the dip sector (afterwards re-invented by Dr Wollaston), and expended time, money, and ingenuity to no inconsiderable amount, in attempting to perfect a marine top for producing a true horizontal reflecting surface at sea. The marine barometer, the snuff-box sextant, and the portable universal dial, owe to him

all their elegance and much of their accuracy. Where others invented or sketched, he perfected.

"Mr Troughton made considerable improvements in several instruments connected with general physics; for instance, in the construction of the balance, and of the mountain barometer. In the same class may be mentioned the form given by him to the compensated mercurial pendulum; his pyrometer, by which some very valuable expansions have been determined; the apparatus by which Sir George Shuckburgh attempted to ascertain the standard of weight and measure; and that which, in the hands of Mr Baily, has given an invariable simple seconds pendulum. On the length of the simple pendulum Mr Troughton himself made many very careful and extensive experiments, according to views and after a procedure of his own; but his methods, though ingenious, were not pursued after Captain Kater's happy application of Huyghen's theorem. The standard scale of this [the Astronomical] Society, and its accompaniments, are noticed in the present Report [to the Society], and described in Mr Baily's Memoir. Among ordinary geodesical instruments, Mr Troughton greatly improved the surveying level and staff, and reduced them both in weight and price, with increased convenience and accuracy. The errors of the common surveying chain, which are sometimes enormous,* and the complexity and expense of that made by Ramsden for the trigonometrical survey, led to the fabrication of a more simple and accurate

* On one occasion, when two surveyors differed in their measurements, their chains were sent to Mr Troughton to compare; one was found two inches too short, the other three inches too long.

chain, at a reasonable cost and of easy use. The larger theodolites by Mr Troughton—those, for instance, of twelve inches diameter—are remarkable for simplicity and power. Of the refined and delicate instruments which he constructed for the most accurate geodesical measurements, we may mention the large theodolite for the American coast survey (1815), and those for the Irish (1822), and for the Indian surveys (1830), which may be advantageously contrasted for their design and simplicity with those, however otherwise excellent, of Ramsden; and also the apparatus for measuring a base line (1827), employed by Colonel Colby in Ireland, and Colonel Everest in India (1829). It must not, however, be forgotten that the project of this last most exquisite apparatus, and the experiments on which it is founded, are due to our excellent members [of the Astronomical Society], Colonel Colby and Lieutenant Drummond. Mr Troughton made some very beautiful and manageable zenith sectors, which were capable of great accuracy and of moderate dimensions; one of these is, we believe, in the possession of the Danish Government, and was employed in the Holstein survey by Professors Gauss and Schumacher. He had designed one for America on the same construction, with a six-feet telescope and arc, but it was never completed, though considerable progress had been made.

"It is, however, more properly with the astronomical instruments of this great artist that we are immediately concerned; and here he reigns without a rival. His portable astronomical quadrants are models of strength and lightness. In the small altitude and

azimuth circle (1792), the portable transit, and the portable universal equatorial, it is not easy to state accurately the line between his improvements or inventions, and those of preceding artists; but it is from him that these instruments received their present form and perfection. The repeating circle of Borda, an instrument which he disliked, first obtained beauty and accuracy from his hands, and for it he invented his double-foot screw, for giving minute adjustments. The ordinary reading micrometer, and the position micrometer employed in the measurement of double stars, were greatly improved by him in simplicity and accuracy; and he first practically applied the former to graduation, though it had already been used in reading off the divisions of circles and scales. In the class of larger altitude circles, revolving freely in azimuth, we find the circle for Count Bruhl (1792), the Westbury circle (1806), that for Sir T. M. Brisbane, the Society's Lee circle, the substance and form of Dr Pearson's circle, those employed in the Indian survey for determining latitudes (1830), and that at the Edinburgh Observatory (1830), with many others which it would be tedious to mention. The beauty of the form and accuracy of the divisions of Groombridge's transit circle (1806), satisfied everybody but the artist himself,* whose experience and matured powers were finally exhibited in the mural circle."

Troughton was the inventor of the mural circle.

* Mr Troughton was, upon trial and reflection, so little satisfied with the design of this transit circle, that he broke up a second, on a somewhat smaller scale, after he had spent £150 upon it. "I was afraid," he said, "I might grow covetous as I grew old, and so be tempted to finish it, and I don't think it is a good kind of instrument."

Until the year 1811, the standard observations at Greenwich were carried on chiefly by means of the quadrants of Graham and Bird; when these instruments were succeeded by the mural circle of Troughton. It requires no great amount of mechanical knowledge to perceive that a quadrant, or in fact any portion of a circle, is necessarily weaker and more susceptible to changes of form from changes of temperature than a complete circle.

Troughton at an early period clearly perceived the inherent defects of the quadrant, and resolved to remedy them by using instead a continuous and unbroken circle. In 1806, he so far completed his plans as to construct a model of an entirely new astronomical instrument, to which he gave the name of the "Mural Circle." This he submitted to the inspection of the President and Council of the Royal Society, strongly recommending it as the best form of instrument for supplanting the old quadrants at the Royal Observatory. As the entire scheme of its fabric differed *in toto* from the old-established type, it was long before they could bring their minds to recommend the Government to adopt it. After much warm discussion they agreed to do so; but the new instrument was not completed until 1811. Instead of determining the zero point of the circle by means of a spirit-level, or plumb-line, Troughton conceived the original idea of measuring the north-polar distance of a star direct from the pole itself. The pole of the heavens is, of course, an invisible point, but its position may be determined with the utmost accuracy by careful observation of the zenith distance of a circumpolar star, as it passes its upper and lower culmina-

tion. The circle was six feet in diameter, and the divisions were read off by six micrometer microscopes fixed on the solid piece to which the whole instrument was attached. It proved incomparably superior to every other instrument hitherto made for the determination of north polar distances, and in conjunction with a similar instrument (almost a counterpart by Jones), was used regularly for forty years; the observations for right ascension being made by a transit instrument of ten feet focal length by Dollond. In 1851, both these instruments were superseded by a new transit circle of much greater power contrived by the present Astronomer-Royal, by which both elements are obtained by the same instrument and the same observation. Troughton's circle, however, along with Dollond's transit and the quadrants of Graham and Bird, are preserved with reverent care, and adorn the walls of the transit room in the Observatory.

Regarding the mural circle the Rev. R. Sheepshanks thus writes:—"This finished specimen of sound engineering and mechanical construction at first met with much opposition; and many were the objections, both before and after the erection of the Greenwich mural (1812), with which its inventor was assailed. To these he resolutely turned a deaf ear, for nothing could shake his confidence in what he *knew;* and he had the pleasure of knowing, before his death, that the mural circle was established at the Royal Observatory of Paris, at the Cape, St Helena, Madras, Cracow (1832), Edinburgh (1834), Brussels (1835), Cadiz, Armagh, and Cambridge (1832). A small model, of two feet in diameter, made for Sir T. M. Brisbane prior to the Greenwich

mural, is now at the Observatory of Paramatta. The principal equatorial instruments of Mr Troughton, with accurately divided circles, are those of Coimbra (1788), Armagh and Brussels (1834). When we add to this long catalogue the large transits at Greenwich* (1816), Camden Hill (1820), Cracow (1828), Markrea (1832), &c., in which differential screws are applied to form what he called the *bones* of the instrument, and the gigantic zenith tube at Greenwich, which he just finished before his strength failed, we have reason to wonder that even his long and active life should have sufficed for works of such variety and extent, and may form some estimate of the value of Mr Troughton's labours, and their effect on modern astronomy. It may, perhaps, be remarked that the only astronomical instrument which is not greatly indebted to Mr Troughton is the *telescope;* and he was deterred from any attempt in this branch of his art by a singular physical defect which existed in many members of his family. He could not distinguish colours, and had little idea of them except as they conveyed the idea of greater or less light. The ripe cherry and its leaf were to him of one *hue,* only to be distinguished by their form; and he was in the habit of relating some curious mistakes committed by himself and others of his relations in confounding green and red. With this defect in his vision, he never attempted any experiments in which colour was concerned; and it is difficult to see how he could have done so with success."

Troughton's colour-blindness has evidently been

* If I am rightly informed, this transit was the work of Dollond.

pretty similar to Dr John Dalton's. A general sketch of the history of colour-blindness will be found in a separate chapter of my Life of Dr Dalton in the preceding volume of this series.

Troughton also may be looked upon as the first artist who constructed a transit circle capable of giving first-class results. A circle of this kind was used by Horrebow in 1735; and one was made by Cary for Dr Wollaston in 1793, but it was too small, and the axis too slender, to give very valuable results.

In George Graham's biography it has been shown that the advancement of astronomy as a science rested greatly on the aid it derived from the arts as well as other sciences; and that instruments capable of measuring the minutiæ in astronomical observations required the finest mechanical work. Graham's powers of "graduation," or the art of dividing mathematical and astronomical instruments, formed quite an era in the history of practical astronomy; and he was ably succeeded in this department by Sisson, Bird, and Ramsden, all of whom continued and improved his work and rendered valuable services to science. None of these worthy mechanicians, however, attained the perfection in the art that Edward Troughton realised after much laborious inquiry and experiment. This is fully brought out in the article "Graduation" of the "Penny Cyclopædia," vol. xi. p. 339.

"The divisions of Graham, Bird, Ramsden, and the elder Troughton, were all performed by the beam-compass, and in a great measure by touch; magnifying lenses were indeed applied to the points of the beam-compasses, but when an

erroneous point is once made, the beam-compass naturally falls into it, and there is considerable trouble in rectifying the error. A French nobleman, the Duc de Chaulnes, after perfecting the micrometer microscope for reading off the divisions for astronomical instruments, first showed how it might be used in actual dividing. He did not, however, follow Graham's rule, and proceed by perpetual bisections; hence his method was neglected, although Ramsden saw the advantage of the micrometer microscope, and used it for reading off the divisions of his circles and theodolites. In this state the art was taken up by Edward Troughton, who, by a happy combination of the principle of Graham, and the Duc de Chaulnes' mode of reading off, and his own ingenuity, brought the division of astronomical instruments to its present state of perfection. We will suppose that a circle is to be divided originally. After the edge of the circle is very carefully turned upon its own centre, a small circular roller, 16 revolutions of which carry it exactly round the circle, is prepared and so fitted to the circle by a radial frame joining the two centres, that on turning the frame round the roller is also turned in an opposite direction by friction between the edges of the roller and circle. The roller is divided into 16 parts, and a microscope placed over the divisions, and as each division comes under the microscope a fine round dot is marked upon the circle, which thus receives an approximate division into 256 (or 2^8) parts. Troughton expected that as the roller could be carried round the circle any number of times without over or under lapping, it would also mark out equal portions at each revolution, but he found himself mistaken, and he therefore proceeded to examine the dots optically. Two microscopes A and B are fixed above the circle nearly in a diameter, and the dots which are to determine the divisions 0° and 180° are bisected by them. The circle is then turned half round, and dot 180° brought under A; if 0° at the same time falls exactly under B, the points are diametrically opposite; if not, the quantity and direction of the error is measured by the micrometer of B, half of which is evidently the error of dot 180°. The microscope B is then shifted and fixed over dot 90°, while A bisects 0°. By a quarter revolution of the circle 90° is brought under A and 180°

under B, and the error, if any, measured and noted. In like manner the error of dot 270° is detected, after which the microscope B is again shifted and fixed over dot 45°, when the errors of dots 45°, 135°, 225°, and 315° are determined. It is easily seen that this is exactly Graham's principle of perpetual bisection, only using an *optical* beam-compass instead of one with points, and *registering* the errors of the dots instead of cutting actual divisions. In this way Troughton proceeded by continual bisections to note the relative or apparent errors of the 256 dots. His next step was to compute the actual or true error of each dot, and to form a table. Suppose that in examining the 180° dot, he found that the arc from 0° to 180° was less than the arc from 180° to 360° by 20", he would conclude that the dot 180° was 10" behind its true place. Again, let the arc from dot 0° to 90° exceed the arc from dot 90° to dot 180° by 30". If 180° were right, 90° would be too forward by 15"; but as 180° is 10" behind its true place, 90° will on this account alone be 5" behind, and therefore on the whole will be 10" too forward. The true errors of each of the 256 dots being thus computed, Troughton returned to the roller, and by help of a small sector which revolved with it and gave him an enlarged scale, enabling him at the same time to reduce the divisions into 256 parts into 360° mechanically, proceeded to cut the actual divisions on the circle."

The quotation given above is a very brief abstract of Troughton's description of his methods of dividing, which he communicated to the Royal Society through the Rev. Dr Maskelyne, then Astronomer-Royal, in the following rather characteristic letter:—

"LONDON, *June* 23, 1808.

"SIR,—The science which you profess, and the art which it has fallen to my lot to cultivate, are so nearly allied, that, had I been personally unknown to you, and a stranger to the patronage which you have always given to the useful arts, I should still have wished the papers annexed to have passed through

your hands to the public. You will readily thence infer how much I feel myself flattered by having obtained from your condescension the privilege of their being presented to the Royal Society through a channel which must secure for them the most favourable reception.

"My reputation for dividing of astronomical and other instruments is by no means unknown to the world, but the means by which I accomplish it I have hitherto thought proper to conceal; and if that concealment had been essential to the advancing of that reputation, or to the immediate security of my own interests, it is probable that it might still longer have rested with myself. Relying, however, as I do, on the probability that I shall find sufficient employment while I am capable of active life, I know of no honourable motive that should prevent me from allowing it to be useful to others.

"How a young artist, who may be just beginning to make his way to fame or wealth, may receive it, I know not; but I wish him to understand that I consider myself now in the act of making him a very valuable present.—I have the honour to be, sir, your obliged and obedient servant,

"EDWARD TROUGHTON.

"The Rev. N. MASKELYNE, D.D.,
Astronomer-Royal, F.R.S."

The first passages of his essay addressed to the Royal Society have an historical bearing worth noting:—

"It would ill become me, in addressing myself to the members of this Society upon a subject which they are so well enabled to appreciate, to arrogate to myself more than may be assigned as

my due, for whatever of success may have been the result of my long-continued endeavours, exerted in prosecuting towards perfection *the dividing of instruments immediately subservient to the purposes of astronomy.* A man very naturally will set a value upon a thing on which so much of his life has been expended, and I shall readily, therefore, be pardoned for saying that, considering some attainments which I have made on this subject as too valuable to be lost, and being encouraged also by the degree of attention which the Royal Society has ever paid to practical subjects, I feel myself ambitious of presenting them to the public through what I deem the most respectable channel in the world.

"It was as early as the year 1775, being then apprentice to my brother, the late Mr John Troughton, that the art of dividing had become interesting to me. The study of astronomy was also new and fascinating, and I then formed the resolution to aim at the nicer parts of my profession.

"At the time alluded to, my brother, in the art of dividing, was justly considered the rival of Ramsden; but he was then almost unknown beyond the narrow circle of the mathematical and optical instrument makers, for whom he was chiefly occupied in the division, by hand, of small astronomical quadrants, and Hadley's sextants of large radius."

In this essay he discusses the merits of his predecessors, and gives a full description of his own original work, illustrated by engravings. It appears that he commenced his first trials of "dividing" as early as the year 1785, so that he had spent twenty years in maturing his plans before submitting them to the decision of the Royal Society. The subject was one of great interest—so much so, that the Hon. Henry Cavendish for a time was induced to leave his engrossing chemical investigations, with the view of throwing light on Troughton's excellent invention.

Mr Troughton's essay was printed in the "Philosophical Transactions" for 1809, p. 105. The Copley

medal was granted for this very valuable and original memoir. Several circles have since been divided after Troughton's method, by his successor Mr Simms, and by Mr Thomas Jones, and it has been thus proved that the merit of Troughton's dividing depended, as he asserted, on the excellence of his processes, and not on his manual dexterity. It is not worth while to divide a circle *originally* which is less than two feet in diameter.

The micrometer, an instrument for measuring small angular distances within the field of the telescope, received much attention at the hands of Mr Troughton. His wire micrometer was a great advance on Gascoigne's, improved by Hooke, and exhibited great ingenuity. A full description of it, with illustrations, is given in the "Encyclopædia Britannica," vol. xiv. p. 743. Mr Troughton had the merit of introducing the spider's line, which, from its fineness, opacity, and elasticity, he found to answer all the purposes of practical astronomy.

The writer in the "Encyclopædia Britannica" expresses his opinion of Mr Troughton thus:—"Mr Troughton, who in his day stood the foremost of our British opticians, more than rivalled his predecessors. In the hands of this distinguished artist and astronomer, the division of instruments was carried to a degree of precision which at the time seemed incapable of being surpassed; while the great improvements he has introduced into the methods of constructing and mounting large instruments, and his ingenious inventions to elude natural obstacles, and guard against the accidental derangements from which it is impossible altogether to protect them, entitled

him to the high place which he held by universal consent among the most eminent philosophers and original mechanicians of the age. The numerous circles and other instruments of his manufacture, whether in the hands of private individuals or deposited in the different public observatories, are considered still as the finest specimens of what art has yet accomplished for the advancement of astronomical science."

Mr Troughton was elected a Fellow of the Royal Society, London, in March 1810; and in 1822, he became a Fellow of the Royal Society of Edinburgh. To the latter Society he made no contributions, but he communicated papers to the *Edinburgh Philosophical Journal*, and *Nicholson's Journal*. How well Mr Troughton stood in the esteem of his contemporaries is sufficiently testified by the following flattering dedication to him of the Rev. Dr Pearson's valuable work, "An Introduction to Practical Astronomy," vol. ii. :—

"To EDWARD TROUGHTON, F.R.S., L. & E., &c.

"MY DEAR SIR,—When I imposed upon myself the task of describing such instruments, as have successively promoted the interests of astronomy, I reckoned upon the continuance of those instructive communications, with which you had occasionally favoured me, during a friendly intercourse of almost thirty years; nor have my expectations been disappointed. The valuable assistance which you have cheerfully afforded me in dispelling my doubts, and in surmounting my difficulties in several instances, demands my most grateful acknowledgment; which

I cannot better express than by inscribing to you the present volume, as a testimony of my great esteem for your extraordinary talents, in common with that of all those practical astronomers, who have had the benefit of using your instruments.—Believe me, my dear sir, your obliged and very grateful friend, THE AUTHOR."

The most remarkable of Mr Troughton's writings, mentioned by Mr Sheepshanks, are "An Account of a Method of Dividing Astronomical and other Instruments by Ocular Inspection," &c., printed in the "Philosophical Transactions," 1809, which was rewarded with the Copley medal; "A Comparison of the Repeating Circle of Borda with the Altitude and Azimuth Circle," in the first volume of this Society's "Memoirs;" and several articles in Brewster's "Edinburgh Encyclopædia," such as "Circle," "Graduation," &c. The descriptions of instruments of his invention or construction, were for the most part furnished by him to the authors of the articles in which they appear; "and an intelligent reader will easily distinguish, by the masterly conciseness of his style (for he wrote in the same spirit as he constructed), the cases and also the extent to which this notice applies. His method of dividing has been generally adopted, and with the obvious modification of dividing by diameters instead of radii, so as to eliminate any defect in the turning of the collar or rim, has not received, and seems scarcely to require, any further improvement. In 1825, Mr Troughton paid a visit to Paris, where he was received with great cordiality and respect by the distinguished artists and

men of science of that metropolis. In 1830, he received an honorary gold medal from his Majesty the King of Denmark.

"Mr Troughton was one of the original members of the Astronomical Society, and at all times sincerely anxious for its prosperity. So long as his health permitted he continued to be a constant attendant, notwithstanding his deafness, on the meetings of the Council and the ordinary meetings of the Society; and his valuable assistance and advice were most readily afforded whenever they were required. His singularly clear understanding, his unimpeachable integrity, and kind though independent temper, made him universally respected; and there was an originality and raciness in his conversation and anecdote rarely to be met with. At times his criticisms might be considered to be severe, but never unfair, except, perhaps, on his ancient antagonist, Ramsden, against whom he fancied he had grounds of complaint.* In every other instance he was as ready to praise as to censure, and gave full and hearty approbation to the masterly conceptions of Graham, the beautiful execution of Bird, and the ingenuity and fertile invention of Ramsden himself. Nor was he niggardly towards his contemporaries and juniors. It may be added that, notwithstanding his high reputation and very simple habits, his carelessness of money did not allow him to become rich, for his object was fame rather than wealth."

In the Royal Observatory at Greenwich, there is a marble bust of Edward Troughton, sculptured by Sir Francis Chantrey, which is said to be a very faithful

* He said that "Ramsden invented an instrument in parts."

likeness of the celebrated mechanician. It was executed, some years before his death, at the expense of his private friends and admirers. Judging from a photograph of this bust, his head was of marked capacity, and presented a contour or formation not commonly met with. His forehead rises with bold sweeping lines towards the crown or vertex, where both breadth and height predominate, and to which the phrenologists would point as exhibiting moral strength and concentrativeness of purpose. The portion of the head in front of the ear, as well as the regions above the eyebrows, are well developed, conditions generally associated in the individual possessing large perceptive and reasoning faculties, and more or less dominant in the mathematician and mechanical inventor. His occiput is protuberant; and if it be true, as some writers assert, that no man ever did much in the world without a big cerebellum,* Troughton deserved a place in the world's esteem. Speaking in general terms, Troughton's cerebral development bore the stamp of moral and intellectual strength, and no less aptitude for the pursuit of art and science; and his long and active life fulfilled the promise of these indications in an eminent degree. His facial features singly offer nothing striking, and therefore need not be particularised. His physiognomy impresses you with

* Physiologists have proved a close relationship between the cerebellum and the motory and sexual functions of man. Now if the phrenological organs of amativeness and philoprogenitiveness laid in this region prevail, it may be a question whether good or evil has arisen from a preponderance of the cerebellum. From Eve's amatory example, theologians tell us, the evils of this world have sprung; and it is to be feared that Eve's fair daughters inherit the maternal weakness. But it is of no use moralising on a subject that has engaged Malthus and the political economists, and yielded no fruit to the preachings of the divine.

his having been a person who, after forming an opinion, would hold pretty tenaciously by it, nor would he at any time be likely to bear untoward questioning. There is real character in his portrait, marked by independence of thought, large grasp of mind, and determined will. He may have shown strong self-assertion, and not been at all times free from abrupt speech and coarseness of manner; particularly if, as the men of Corney or of Cumberland would say, his hair was not stroked in the right way.

Since writing the above estimate of Troughton's personal character, derived strictly from a study of his photographed bust, I am favoured with some remarks from one who remembers Troughton well, and as duly appreciated his high services to astronomy. From him I learn that Troughton was so thoroughly engrossed in his work as to be quite heedless of his personal appearance. He was slovenly, and his strong propensities to snuff-taking made him look still more untidy. In his latter days, he appeared a dirty old man, in dirty wig and black dirty shorts, in the back parlour of No. 136 Strand (two doors from Simms' present shop). This snuggery of his was as dingy and dirty as himself. The outside show of the man was evidently the worst part of him. "He was liberal in his general conduct; for instance, when, in reference to some of the Cambridge instruments, he was asked if he would give Mr T. Jones his advice, he said he would communicate with him as freely as with his own partner. He was very independent in action, and would make instruments only to his own plan." This trait in his character may have helped to involve him and his partner in a troublesome law-suit with Sir

James South, who wished an equatorial made by Troughton, at the same time he sought to graft his own less experienced views on the great mechanician's work. The consequence of such a copartnery in labour might have been foreseen; the instrument did not fulfil all the indications expected, and Sir James South refused to pay for it, until an action at law compelled him. The controversy that arose out of this action, in which Troughton and Simms were the plaintiffs, and Sir James South the defender, brought forth an angry correspondence, the history of which will be found in the Rev. R. Sheepshank's "Letter to the Board of Visitors of the Greenwich Royal Observatory, in reply to the Calumnies of Mr Babbage at their Meeting in June 1853, and in his Book entitled, The Exposition of 1851." London: Printed by G. Barclay, Castle Street, Leicester Square. 1860.

Mr Troughton died at his house in Fleet Street, London, June 12, 1835, in the eighty-second year of his age, and was buried, according to his request, at the Cemetery, Kensal Green. Many of the members of the Astronomical Society, and other sincere friends of the deceased, paid their tribute of respect to his memory by attending his funeral.

The Rev. R. Sheepshanks, who was Mr Troughton's executor, says nothing as to the disposal of his friend's property. Troughton's love of science, the keen interest he felt in the improvement and extension of his own art, and his special regard for the cause of navigation, where so many valuable lives and interests were at stake, evidently made him less attentive than most men to his own pecuniary advantages. And,

judging from what Mr Sheepshanks has said in page 121, it is probable that Troughton's savings were not at all commensurate with the extent of his business; indeed, he seems to have attached vastly more interest to his personal success as a scientific artist than to the hoarding of moneys. On Troughton's death, the estate of Welcome Nook fell to his sister, who had married a Mr Suddard, in whose family it now remains.

It is pleasant to add that the men of Corney point with pride to the farmstead of Welcome Nook, where, if not at Park-Nook, the noted mathematical instrument maker was born. In the garden of Welcome Nook, and in the churchyard of Corney, are sundials said to have been constructed by Edward Troughton, and presented by him; and these are the only tangible facts associating this remarkable man of European reputation with the locality of his birth.

In preparing this memoir, my thoughts have frequently reverted to George Graham, the prototype of Edward Troughton; and now seems a fitting opportunity for comparing the character of these two worthies, and of saying a few words on their historical status. Though noted as a clock and watch maker, Graham was equally great in the fabrication of astronomical instruments—the leading pursuit of Troughton. Both men followed a special department of art, which England, to her honour be it said, has done more to advance and perfect than all the rest of the nations; and no two individuals, of the past or present century, contributed more largely to this exalted position than the two Cumbrians, George

Graham and Edward Troughton. Such praise is not offered unadvisedly, or without due knowledge of these highly meritorious mechanicians, Bird, Ramsden, Dollond, and others, men of thorough achievement and historical renown. During the interval which elapsed between the death of Graham in 1751, and the full maturity of Troughton's powers, Bird and Ramsden were deservedly in the front; but it is not too much to say that Troughton in time eclipsed all his home rivals; and by his incomparably superior skill gained the entire confidence of every astronomical observer in Europe.

Although their *forte* was Art, the higher embodiments of which they practised with a rare success, that art was so interwoven with the science of the physicist, that it would be taking too limited a view of their operations to classify them as mere mechanicians; moreover, science inspired their art, and to a degree of efficiency that implied a cultivated knowledge of astronomy.

The reader can hardly have failed to remark how much these two Cumbrians, Graham and Troughton, were alike in humble origin and education, in powers of design and invention, and also in general character. And those who have done me the honour of perusing John Dalton's life in a preceding volume, may be disposed to trace certain mental affinities and other analogies affecting the chemist, alike with the two mechanicians. All three, Dalton, Graham, and Troughton, sprang from the lower strata of agricultural life, upon which were grafted weaving, shoemaking, or other humble handicraft. None of them received any education beyond the merest rudiments

afforded by a village school; and even this small privilege came to an end in the first days of their puberty. They were all bachelors, of simple and retired habits; highly temperate and frugal in expenditure; of estimable character and unswerving integrity. They were plain and tolerably outspoken, and when occasion required, could call a spade a spade. Troughton's non-amiability, when it occurred, appeared the more that his face was imperfectly washed and snuffy to a degree. The constant aim of these men was to reach the highest excellence in their own line, be it art or science; and this pre-occupation of their minds made them indifferent to the fitful throbs of political life, and the impulses of worldly ambition. The ups and downs of Whig and Tory, the polemics of the Church, the growls and feuds of municipal and parochial coteries, in no wise disturbed their equanimity. Born for work, and the tried diligence that makes more lasting acquisitions than valour, they fought their honest way in the world, never disheartened by obstacles, and never doubtful as to the result of their endeavours.

Each of these worthy pioneers in discovery and invention, rose to the very head of that particular branch of science to which he devoted himself; and happily not the slightest hesitation was ever expressed on the part of their compeers, as to the validity of their claims to originality and the high historical regard due to masterly achievement.

It has already been shown that the inventions of Graham and Troughton formed important eras in the history of Astronomy. Now every new instrument of research creates new thoughts and new opportuni-

ties for observation; and the knowledge so gained is like the action manifested in the maturation of the organic cell, which grows out of itself in manifold ways, and ripens into higher and higher developments, bearing no less on the theoretical views of science, than the practical aims of political economy and philanthropy. The benefits accruing to humanity from the life-long labours of these eminent men, are not easily measured. The influence they exercised on their own generation was considerable, by lending a fresh impulse to chemical and physical research, that in the course of time enlarged the fields of industry, brought the men of science from all parts of Europe into friendly association, and tended towards that consummation devoutly to be wished, when the nations of the earth will gather under one flag, inscribed—Peace, science, commerce, and civilisation.

Dalton was everywhere looked upon as the most illustrious chemist of the century. Graham, apart altogether from his astronomical work with which his name will ever be associated, was the best clock and watchmaker in Europe. Troughton in his time had no superior as a maker of the highest class of astronomical instruments; which instruments are to be found in all the great observatories on the Continent. Such a trio of worthies, born within the compass of a middle-sized English county, taken *cæteris paribus*, can hardly be equalled throughout the length and breadth of the land.

These famed Cumbrians were of a marked robust nature and untiring energy, and throughout their long career staunch upholders not less of the spirit

than the true dignity of labour. Nature had given them brains of exceptional force in conjunction with constitutions of exceptionally good fibre; and these precious boons were exercised to the highest advantage. How far they were indebted to their ancestry for their organic and intellectual activity can only be a matter of conjecture; in other respects they were truly self-made men of high capacity and merit. Yet how narrow was their escape from the toils of bucolic life, and the deadening moral influences attached to this condition in such remote districts of country as Corney, Eaglesfield, and Kirklinton. One cannot help reflecting on this and other remarkable facts in their history, and wondering if Cumberland had not other sons equally good and true, who were doomed to spend their days on the clay fallows of their native parish, but who, if placed in more congenial positions, would have risen to some favour and distinction in the world.

It must be conceded that Dalton, Graham, and Troughton were cast in no ordinary mould; but rather examples of the best type of men to be found among the denizens of "the north countrie;" and it is curious to note how much of the practical work of England—as seen in our mechanical operations, from the minute structure of watches to the massive yet equally fine adjustments in various branches of civil engineering; in the construction of bridges, roads, and railways; in the promotion of navigation, commercial enterprise, &c.—has been accomplished by our northern worthies. The department of art so ably represented by Troughton owes almost all its greatness and efficiency to four men, the widest

separation of whose birth was Kirklinton in the north, and Leeds in the southerly direction. The cropping out, from such unlikely habitats as weaving shops and poor farmsteads, of men endowed with special faculties, who could find no social or industrial rest but in the pursuit of callings fitted for the display of these faculties aright, would deserve much more than a passing notice. To pursue the subject, however briefly, might be deemed out of place, as being calculated to tempt me too far into the domain of anthropology, and the discussion of a theme highly engaging to the physiologist, and of no small interest to society at large.

The following are references to the books in which Troughton's principal instruments are described :—

British Reflecting Circle. Brewster's Encyclopædia, Vol. vi., p. 488. Plates CLXIV.–V.

Nautical Top. Brewster's Encyclopædia, Vol. xviii., p. 70.

Sir G. E. Shuckburgh's Scale and Apparatus. Phil. Trans. 1798, p. 133. Plates V., VI., VII.

Mr Baily's Pendulum. Phil. Trans. 1832, p. 403.

Astronomical Society's Scale, &c., Mr Baily's Report, &c., Mem. Royal Ast. Soc., Vol. ix.

Portable Zenith Sector. Pearson's Practical Astronomy, Vol. ii., p. 546. Plate XXXII.

Astronomical Quadrant. Brewster's Encyclopædia, Vol. ii., p. 725. Plate XLV.

Astronomical Quadrant. Pearson's Practical Astronomy, Vol. ii., p. 555. Plate XXIX.

Portable Altitude and Azimuth. Brewster's Encyclopædia, Vol. vi., p. 492. Plate CXLVI.

Borda's Repeating Circle. Brewster's Encyclopædia, Vol. . p. 498. Plate CXLVII.

For these two instruments see Mr Troughton's Memoir in the first volume of the Astronomical Society's Memoirs.

Position Micrometer. Pearson's Practical Astronomy, Vol. ii., p. 99. Plate XI. Figs. 1, 2, 3.

Westbury Circle. Phil. Trans. 1806, p. 420. Plate XX.

Sir T. M. Brisbane's Circle. Brewster's Encyclopædia, Vol. ii., p. 727. Plate XLVI.

Pearson's Circle. Pearson's Practical Astronomy, Vol. ii., p. 434. Plate XIX.

This circle was divided by Mr Thomas Jones by Mr Troughton's method.

Groombridge's Transit Circle. Pearson's Practical Astronomy, Vol. ii., p. 402. Plate XVII.

Mural Circle. Plate in Pond's Observations, Vol. i.; Pearson's Practical Astronomy, Vol. ii., p. 742. Plate XX., but no detailed description of the instrument has yet appeared. The circles of Cracow and Cambridge are by Messrs Troughton and Simms.

Coimbra Equatorial. Pearson's Practical Astronomy, Vol. ii., p. 519. Plate XXV.

Armagh Equatorial. Rees' Cyclopædia, Vol. xii.; Art. "Equatorial." Plate XVI. Astron. Instr. Transact. Royal Irish Academy, Vol. xv., p. 1.

Greenwich Transit. Pearson's Practical Astronomy, Vol. ii., p. 366. Plate XVI.

Camden Hill Transit. Phil. Trans. 1826, p. 423. Plates XVI., XVII.

REV. WM. PEARSON, LL.D.,

ASTRONOMER.

"How beautiful this night! . . . .
. . . Heaven's ebon vault,
Studied with stars unutterably bright,
Through which the moon's unclouded grandeur rolls,
Seems like a canopy which love had spread
To curtain her sleeping world."—SHELLEY.

SITUATED at the base of the lofty mountain Black Combe, and bordering the Irish Sea, is the small parish and village of Whitbeck; almost at the south-western extremity of Cumberland. Like its neighbour, Corney, described in the preceding memoir, in isolated retirement and general characteristics, Whitbeck retained its ancient usages and superstitions till a late date; and perhaps it may now be questioned if these traits of the uneducated mind are quite swept away. Its sparse population found it advisable to select the lower slopes of Black Combe for sheltered residences, and for the better avoidance of the agues and rheumatisms that were too frequently generated by daily exposure to the damp and morassed grounds on the alluvial level. These quiet country folk lived on the imperfect tillage of

their lands, the small beeves and fell-side sheep; and could gratify their love of fasts or, as it might be, feasts, by the abundant yield of the fisheries in the adjacent sea; for Whitbeck had its small band of fishermen, who traded with St Bees and the Isle of Man, from whence, when fortune favoured, they could smuggle a few pounds of tea or a keg of brandy. Trusting to their farms and flocks for wholesome nutrition and needful clothing, the villagers of Whitbeck were independent of beershops and general stores; nay, such were their plain and simple habits that, at the beginning of the present century, neither a public-house nor a grocer's shop existed in the parish. All the intercourse these primitive people had with the rest of the world was on occasional market-days at Bootle or Broughton, where they went to dispose of their surplus grain and potatoes, and to obtain a few luxuries of tea, sugar, and currants; possibly a "better cap" for the "fruitful vine" or "missus," and a bit of blue ribbon for the baby's christening frock. What delightfully happy people, enjoying, in their primitiveness, health and labour and sweet contentment!

There was much neighbourly feeling and hospitality of its kind in these outlying districts; where newly married peasants begged corn to sow their first crop, and got well helped: such persons were termed *corn-laiters*. The superstitions of the people led them to keep *wake* with the dead, probably not to the extent, or in the boisterous fashion, of the vivacious Celt in the land of Erin. Among other popular notions described by the subject of this memoir to "Hutchinson's History of Cumberland," the Whitbeckians believed

"that the labouring ox knelt at twelve o'clock at night, preceding the day of nativity; and that bees were heard to sing at the same hour! To whatever quarter a bull faces in lying on All-Hallow-Even, from thence the wind will blow the greatest part of the winter." Even their meats were prepared in accordance with certain forms of superstition; thus "on the morning of Christmas-day they breakfasted on *hack-pudding*, made of sheep's heart chopped with suet and sweet fruits."

Whitbeck was not without its salient points of interest to the educated tourist, the man of science, and the archæologist. The indications of an "entire and capacious crater of a volcano" on the side of Black Combe, and the deeply buried trunks of oak and fir in the morasses, might claim the notice of the geologist; the remains of the so-called Druidical monuments of outer and inner circles of stones, *e.g.*, "standing stones" and "kirk stones," were worthy of the archæologist; whilst the philologist, if he could only find the oldest inhabitant, might have his lore and patience tested in tracing the origin of the antiquated language and expressions of the people who used a dialect hardly intelligible beyond the broader shadows of Black Combe itself. In the past century, Whitbeck had a natural history product in the medicinal leech, found in a tarn near Gutterby; which it is said a woman came all the way from Edinburgh to gather. The inhabitants of the district required no such animals; nor did they look with much equanimity upon the *ignes fatui*, or "Will-o'-the-wisps" in the morasses—such luminosities of natural objects

being held as rather uncanny things to the non-luminous minds of Whitbeck.

The Pearsons of Whitbeck were heard of in the seventeenth century as highly-respected yeomen, but the only record now attainable of a family, apparently extinct in the parish or neighbouring district, is to be found on a memorial slab * in Whitbeck Church. From this it appears that a John Pearson had for wife Frances Postlethwaite; both of whom died in 1772—John at the age of eighty-one years; his wife at the age of seventy years. They had issue William, who married Hannah Ponsonby, to whom a son (their eldest) was born in 1765, and whom they named John. Although there be nothing on this memorial slab regarding William Pearson, the subject of this memoir, it is fair to infer, as his birth took place on April 23, 1767, that he was the second son of William and Hannah Pearson of Whitbeck. The circumstance of William leaving Cumberland and being buried at South Kilworth, Leicestershire,

* I am indebted to the courtesy of the Rev. Thomas Ormandy of Whitbeck, for the following inscription on the memorial slab in the Church of Whitbeck: a portion of the inscription seems to be obliterated :—

"To the memory of those regretted relations whom within half a century four successive generations departed.

This record of mortality is inscribed by a grateful survivor.

John Pearson, was interred Feb. 7, 1772, aged 81.
Frances, his wife (a Postlethwaite), Nov. 23, 1772, aged 70.
William, their son, Feb. 8, 1795, aged 62.
Hannah, his wife (a Ponsonby), June 15, 1800, aged 61.
John, the eldest son of William, Oct. 31, 1816, aged 51.

His children:
Hannah, March 7, 1802, aged 8.
John, July 19, 1818, aged 17.
Elizabeth, Nov. 2, 1818, aged 20.
Joseph, May 9, 1829, aged 19.
Hannah, July 30, 1830, aged 20."

may account for his name not appearing in this simple yet somewhat rude and imperfect record of his ancestry or, as may be, portions thereof only.

The respectability of the Pearsons may in part be vouched for by their matrimonial alliances with the Postlethwaites and Ponsonbys, families well known in the west of Cumberland. Yet the curious fact remains, that had it not been for "a grateful survivor" there would not have been even the imperfect "record of mortality" of the Pearsons to be found in Whitbeck Church. This would naturally imply that the family had become extinct on the male side at least, or that their reverence for departed friends was marked by great supineness.

William Pearson, the subject of this memoir, was educated at the grammar school of Hawkshead, founded by Archbishop Sandys, on the north-west border of Lancashire. At this school many Cumbrians, *e.g.*, Wordsworth the poet, received an excellent groundwork, fitting them for taking good positions in the British universities. Between his leaving Hawkshead and his becoming a clergyman of the Church of England, I have no facts to guide me; but it may be inferred that he went to Cambridge, to which university his mathematical penchant would seem most favourable. The chief points in his history are recorded in the "Memoirs of the Astronomical Society," vol. xvii. pp. 128–133, from which narrative I borrow largely, having looked in vain for information in other quarters that could be deemed equally trustworthy. The Rev. Dr Pearson * is said to have

* Having among other titles that of LL.D., Pearson is always spoken of as the Rev. Dr Pearson.

very early shown a strong liking for mechanisms of various kinds. "While residing at Lincoln he constructed a portable clock (still in the possession of his family), which showed the phases of the moon in conjunction with the ordinary time. He contrived and executed various machines for exhibiting and explaining astronomical phenomena, among which are mentioned various planetariums, and an exemplification of the system of *Jupiter*. Finally, he constructed 'a large orrery * with equated motions,' of which there is a description by himself in Rees' Cyclopædia. He made, too, with his own hands, an altitude and azimuth instrument, which is now in the possession of Mr Patrickson, his nephew."

"In 1811 Dr Pearson became the proprietor of a celebrated establishment at Temple Grove, East Sheen, where many of the nobility and gentry received their preparatory education. Here he built an observatory and furnished it with instruments."

"In 1817 Dr Pearson was presented, by Lord

* Orreries and planetariums were great things in their day. In referring to what was done in the last century, Mr Reid ("Treatise on Clock Making," p. 51) writes :—"None have displayed such a knowledge of this subject as has been done by the Rev. Dr Pearson, who certainly has taken uncommon pains, in which he has completely succeeded by having the motions of the planets to be more correctly represented in an orrery or planetarium than has hitherto been done. The numbers he gave for the motions of Jupiter's sattelites were published 10th March 1798, in 'Nicholson's Journal,' vol. ii., 4to edition, p. 122, *et seq.*, which was somewhile before we had any account of Janvier's *Sphere Mouvante*, whose numbers for the same motions were so nearly similar to those of Dr Pearson's, that we could hardly be restrained from suspecting, at first sight, some degree of plagiarism on the part of M. Antide Janvier; but having taken, as we are led to suppose, the same way to find numbers for the teeth of the wheels, &c., in his planetary machine, as Dr Pearson did, and the principle being a general one, the results would, and most naturally, be the same."

Chancellor Eldon, to the rectory of South Kilworth, Leicestershire, where (after quitting Temple Grove in 1821) he constantly resided. An observatory was at first arranged in a new wing to the rectory-house, but he ultimately erected a detached observatory on a considerable scale, and at a convenient distance. Here he set up the principal instruments which he had collected, and employed a permanent assistant, whom he carefully trained in observation and computation."

"Dr Pearson contributed very largely to Rees' Cyclopædia, having furnished, as we believe, *all* the articles which relate to practical astronomy, and to the mechanical construction of timekeepers, telescopes, instruments, orreries, &c. These extend to sixty-three separate contributions, illustrated by 110 plates, which must have given him considerable occupation during the years 1806-1818, when the work was in progress. Probably he derived considerable assistance from his intimate friend Troughton, as well as from Tulley, Hardy, &c., all most eminent artists at that time in their respective callings; still he must have relied mainly on his own practical skill as a mechanician, and on his own personal acquaintance with the tools and methods of astronomy."

"In 1824 Dr Pearson published the first volume of his great work, 'A Treatise on Practical Astronomy,' in two large 4to volumes. This first volume consists chiefly of tables, most of which were computed specially for the work under the author's direction. It is dedicated to the president, vice-presidents, and members at large of the Astronomical Society. In 1829 the second volume appeared, dedicated

with great propriety to his intimate friend, the distinguished artist Troughton. In this volume Dr Pearson communicated not merely descriptions of instruments, but whatever his long practice had taught him of precautions in observing or methods of reduction. At the present time, so great has been the advance of astronomy in the last twenty years, the 'Treatise on Practical Astronomy' must rather be considered a book of reference than one of routine and direction. It will always continue to be of great value, and is necessary as a commentary and illustration of this branch of our science during the generation just past. This laborious and costly work was published at the expense of the author with a certainty of great pecuniary loss."

"When the establishment of an observatory at Cambridge was proposed on the grandest scale, and at an outlay greatly beyond the means of the University, Dr Pearson contributed fifty guineas in aid of that spirited design."

"He was appointed a Visitor of the Royal Observatory of Greenwich by Mr Davies Gilbert, then President of the Royal Society, when the Board of Visitors was remodelled; and so far as his health permitted, he was a regular attendant on their meetings."

"Dr Pearson retained his mental faculties and bodily strength to an advanced age, though suffering occasionally from attacks of gout. He died at South Kilworth on September 6, 1847. He was twice married, and left an only daughter by the first marriage; the second Mrs Pearson survives him."

"Such are the principal events of Dr Pearson's scientific life which we have been able to collect. He outlived most of his contemporaries and familiars, or undoubtedly more particulars might have been gathered with profit and related with interest. To the record of his exemplary professional life as a clergyman and magistrate, we can scarcely be considered parties."

"All mention of Dr Pearson's connection with the Astronomical Society has been hitherto omitted, in order that it might be presented at once. Unfortunately even here there is some uncertainty which we are not at present able to clear up."

"It seems highly probable that to Dr Pearson we owe it that an Astronomical Society was founded. Existing documents prove that he took steps to originate such an institution as early as 1812, and that in this laudable attempt he was assisted by Mr Troughton, Dr Kelly, and others, whom we find among our earliest and warmest supporters. In 1816 this proposal had taken so much consistency, that Dr Pearson, at the request of his coadjutors, wrote a preparatory prospectus and address, which were, he says, submitted to Lord Erskine, probably with a view to obtain his lordship's countenance and influential aid."

"The documents in our possession do not enable us to trace the origin of the Royal Astronomical Society further back than January 12, 1820. On that day, a meeting was held at the Freemasons' Tavern, which agreed unanimously to constitute themselves into a society for the cultivation of astronomy, to circulate an address explanatory of their objects, and to invite

the co-operation of such persons as were inclined to join their body.

"The address was written by Sir J. Herschel, and is entitled, 'Address of the Astronomical Society of London,' with the date 'January 1820.' It will be found in the beginning of the first volume of the 'Memoirs.' Sir John Herschel recollects that Dr Pearson was active in pressing this service upon him."

"On February 8, the Astronomical Society met at the house of the Geological Society according to appointment, and assented to the rules and regulations (see 'Memoirs,' vol. i. pp. 9–20) which were proposed by the committee. Dr Pearson was appointed treasurer *pro tempore*."

"At the adjourned meeting of February 29, the officers of the society were elected, and Dr Pearson was confirmed as treasurer."

"This meagre account is all that can be confidently presented as vouched for by existing documents in the possession of the Society. There is nothing to show by whom the meeting of January 12 was called, but it is said to have been resolved upon at a dinner-party given by Dr Pearson at East Sheen, and mainly at his suggestion. It is clear that the first proposal of an Astronomical Society proceeded from Dr Pearson; that this proposal was kept steadily in view by him, and agitated for several years; and that he was one of the earliest and most zealous members when it was actually constituted. He continued in office as treasurer for more than ten years, and resigned on June 11, 1830, when his non-residence in London and increasing age made his attendance at the Council too onerous."

"A specimen of flint-glass was presented to the Society in 1823 by M. Guinand, of Neuchatel, which, with a disc of English plate, was worked into an object-glass of 6·8 inches aperture, and twelve feet focal length, by Mr Tulley. After careful examination (see 'Mem. Ast. Soc.,' vol. ii. p. 507), the council offered this object-glass to sale by public tender, the overplus, after Mr Tulley's charge for working was paid, being designed as a remuneration to M. Guinand. On this occasion Dr Pearson alone made a tender, and his liberal offer of £250 was accepted. If we are right this was at that time the largest object-glass in England, though it has since been greatly surpassed by object-glasses imported from the Continent, and by the works of our own opticians.

"The gold medal of the Society was awarded to Dr Pearson in 1829 for his 'Treatise on Practical Astronomy,' when the complimentary address was delivered by Sir John Herschel, at that time president. The unsold copies of this valuable work have been for one or two years stored in our apartments, and were bequeathed by the author to us, along with the illustrative copperplates."

"The Society's 'Memoirs' contain several contributions from Dr Pearson. It is understood that he left a supplement to his 'Catalogue of Stars within 6° of the Ecliptic' in considerable forwardness."

At the annual general meeting of the Astronomical Society of London, on February 13, 1829 ("Memoirs of the Astronomical Society," vol. iv., part i. p. 216), on presenting the honorary medal, Sir J. F. W. Herschel, President of the Society, said:—

"GENTLEMEN,—

"The first medal which I shall this day have the honour to present, according to the award of your Council, is a gold medal to Dr Pearson, for his book entitled 'An Introduction to Practical Astronomy,' one of the most important and extensive works on that subject which has ever issued from the press. The treatises existing on theoretical astronomy are numerous and extensive, as befits the dignity and abstruseness of the subject; but works on the practical department, explaining the best methods of observing, and the precautions necessary, —condensing and bringing together the tables most compendious or more generally adopted, and describing in detail the various instruments employed,—the manner of using and adjusting them, and the species of observations for which they are adapted;—such works were altogether wanting, or existed at best in a very insufficient state. We have here, however, the desideratum supplied. Dr Pearson, in his first volume, has brought together all the tables which the practical astronomer is ever likely to want. Nor is this a mere compilation. Nearly half the volume consists of new tables, and the rest are for the most part either extended or improved in their arrangement. The most considerable and striking part of Dr Pearson's work, however, is the second volume, now just published. This is destined to a description of instruments, and is accompanied with a series of plates, so complete as almost to render description superfluous. It is no small advantage in such a case to know that the instruments described have been for the most part in the actual possession of their de-

scriber, and used by him in actual observation. Such has been the case in this instance."

The President then addressing Dr Pearson, continued thus :—

"Dr PEARSON,

"You have applied your splendid collection of instruments to a most excellent use. You have not frittered your time away in commencing, and breaking off, a series of observations with one and with another, at the impulse of the moment, but, by studying their peculiarities, noting down their adjustments, and delineating their forms, you have given a most useful aid to those of less experience than yourself, and have added a value to every instrument you have described, by your labours. In dedicating this second volume of your book to our admirable Troughton, you have raised him a monument which must be peculiarly gratifying to his feelings. In your pages he may see how large a place he occupies in his art, and in the science on which it depends; and we all rejoice that he has lived to receive this applause at your hands. For yourself, sir, be assured, this society, who know the sacrifices you have made, and the liberality with which you have set at nought all calculations of profit and loss in producing a work of such vast expense and such small probable return, congratulate you heartily on thus bringing your labours to a close, and mark the epoch by presenting you with this medal."

Dr Pearson was elected Fellow of the Royal Society in 1819. He was also Fellow of the Royal Astronomical, and other learned societies in London. He

long officiated as one of the Board of Visitors to the Royal Observatory of Greenwich.

On a tablet fixed against the north wall of the nave of South Kilworth Church is inscribed :—

TO THE MEMORY OF THE
REVD. WM. PEARSON, LL.D., F.R.S.,
RECTOR OF SOUTH KILWORTH,
WHO DEPARTED THIS LIFE
ON THE 6TH OF SEPTEMBER 1847,
IN THE 81ST YEAR OF HIS AGE.
UNIVERSALLY BELOVED AND REGRETTED.

FEARON FALLOWS,

WEAVER AND ASTRONOMER.

"O poor man's son, scorn not thy state;
There is worse weariness than thine
In only being rich and great:
Toil only makes the soul to shine,
And makes rest fragrant and benign."

THE Borough of Cockermouth and its adjacent villages have furnished a large and valuable contingent to this series of "Cumberland Worthies." How this superiority of claim over the general birthright of the county has arisen, and within so small a circuit, is a question that does not admit of very ready solution; moreover, the reasons that might be advanced towards an explanation would necessarily lead to much physiological comment. Looking back a century or more ago, to the comparative isolation of Cockermouth, and the paucity of its population, whose industry was a good deal limited to the manufacture of shalloons,* stockings, and hats; or even coming nearer to our own day, the observer fails to perceive

* The term "shalloon" is applied to one of the old woollen fabrics first made at Chalons—the name afterwards corrupted into shalloon.

either a nidus for the nurture of men of mark, or the presence of circumstances calculated to stir the pulses and imagination of the rising generation.

Man, as everybody is aware, rests any superiority he may possess over his fellow-men on his brain-structure, the development of which apparently owes no greater obligation to the busy marts of our great cities, where Jews and Gentiles, with sharpened wits, most do congregate, than to the dreary stillness of bucolic life. In other words, the brain viewed in its functional activity is not a germinal product of patrician blood, nor can it be bought, like "the wealth of the Indies," by our rich millionaires, but is rather one of the resultants of our higher civilisation, tending more and more to the perfection of the organisation and capabilities of our species. In the promotion of this great desideratum, the plebeian classes have borne their fair share, if not a larger part, than the educated and favoured of the land.

The biological doctrines of the present day clearly denote that man, in the different stages of his growth, enjoys no higher privileges than the lower genera of the vertebrate kingdom. His organism passes through the same phases of development, and in his maturity he is subject to the same influences arising from climate, habit, and natural selection; his psychologi-

These goods would seem to have been originally used for coverlets. Thus Chaucer describes—

"a bedde
With shetes and with chalounes faire y-spredde."

In "Ye old usages of ye citie of Winchestre," quoted in the late Mr Toulmin Smith's work on "Ancient Gilds," it is ordained that "non of the citie ne shall don werche qwyltes ne chalounss without the walles of the citie."

cal attributes alone raise him above the simian tribes —his close allies in type, with whom indeed there is found to be a greater affinity than theologians like, or than physiologists were long prepared to admit. Reflecting on these natural laws, it need not excite surprise that, from time to time, and under conditions apparently in nowise favourable, men of real distinction have come to the front, showing their special characteristics as conspicuously amid the common herd of humanity as the lofty pine and majestic oak tower above the stunted growth of the forest. These instances of highly-endowed brain-power, full of biological interest as marking the progressive development of our species, should probably be viewed by the light of race*—a light that has illuminated many an obscure page in the history of nations, and not seldom proved the narrow and destructive policy of both autocrats and diplomatists.

Among the fortunate few whose talents have shed a lustre on the history of Cockermouth, neither family alliances nor hereditary influences seem to have operated much, if at all, in raising them to a higher status than their parentage indicated,—the dominant faculty in each individual alone imparting an irresistible impulse to the direction of his part and work in the world. Whilst admitting that a bias may be given to the individual thought, thus corroborating the idea that man is more or less a creature of circumstances, it is no less true that his moral and intellectual scope rests vastly more on his mental constitution than on his social surroundings. The

* This subject is briefly discussed in my "Life of Robert Knox, the Anatomist" (Macmillan & Co.), 1870.

healthful feeling of rivalry, the instinctive love of ambition, the potent stimulus of necessity, and the like agencies, greatly influence the career of numbers of citizens who might otherwise have fallen into the common groove of everyday life, and been no more heard of. To confine my remarks to the present narrative,—the poetical, mathematical, and scientific tendencies of the more gifted denizens of the Cockermouth district would seem to have been born with them; so that the oft-quoted words, "*Poeta nascitur non fit*," are as applicable to them as a general group as they were to the birth of Horace himself; and so far tend to strengthen Mr Galton's lately-collected evidence in favour of the scientific bias of our English *savans* at least being "decidedly innate," in the majority of instances. However this may be, it is worthy of note that lads of various minds and temperaments, and chiefly springing from the lower grades of society, have carried their satchel and shining morning face to school along the banks of the Derwent, or its neighbouring heights, little conscious of their steps leading from the paths of rural mediocrity to positions of fame as endurable as history itself.

Cockermouth can boast of a stirring political history, in which the Curwens, the Grahams, the Lawsons, and the Lowthers (taken alphabetically)—Whigs, Radicals, and long-horned Tories—have played bold and expensive parts in defence of their respective banners of blue and yellow. And though these contests in the feudal, transitional, and reformed periods of our history are not wanting in real interest, as marking the struggles and progressive stages of Eng-

lish freedom, a time will come, if its shadows are not already cast before, when a higher regard will be felt in the Parliamentary borough of Cockermouth as the nursery of Dalton, Wordsworth, and Fallows,—the men of genius who have not only conferred lasting fame on the locality of their birth, but have made their names known to the ends of the earth.

Fearon Fallows, the subject of this memoir, was born on July 4, 1789, in the first house on the left of Low Sand Lane, Cockermouth. This lane or narrow street, leading from the main thoroughfare of the town towards the river Derwent, alone separates the birthplaces of William Wordsworth and Fearon Fallows; yet these two lads were very differently circumstanced in the world. Wordsworth was nursed on the carpeted drawing-room of one of the best mansions in Cockermouth. Fallows had to find his feet, as best he could, on the sanded floor of a weaver's kitchen. If the Spirit of the Muse chose to cast her smiles on the well-to-do solicitor's son, the Genius of Science irradiated the bare walls and dingy loom-recesses of the household of John Fallows, the weaver, giving to his first-born a marvellous aptitude for numbers and geometry, the most important branch of the mathematical sciences.

John Fallows, the handloom weaver, had a large family, and lived in most humble circumstances. As with all poor men's children, his oldest boy, Fearon, was turned to some account at an early age, filling the spools, and helping in the different services attached to a weaver's household, very much in the way that John Dalton had to act in his poor home at Eaglesfield; and when his limbs were long enough to

reach the treadles of the loom, he was regularly apprenticed to his father's handicraft, and is said to have laboured at it till his nineteenth year.

The most current and best-authenticated story of Fearon Fallows' early genius would imply that, at the age of six years, he mentally computed the number of farthings in a guinea. This arithmetical effort astonished his father, as well it might; and as Fearon continued to manifest his precocity in similar methods of calculation, the parent's instincts were directed to the channels most available to the promotion of his son's education.

Instead of the Free Grammar School at Cockermouth, young Fallows was sent to Mr Cooper, a schoolmaster of repute at Brigham, two miles distant, under whom he got his early mathematical training. The lad's zeal and acquirements in geometry were such that he soon trod on his master's heels; and it is said that "old Cooper" was frank enough to admit their equality, or rather the superiority of his pupil, by sending for his father, whom he thus addressed:—"John Fallows, I'll not rob you any more." "What do you mean?" inquired Fallows senior; to which the schoolmaster replied, "Your boy is as able to teach me as I am to teach him, so I can take no more quarter-pence from you." This of course determined the removal of Fearon from school. A Mr Bowman has been mentioned as having in part assisted Fearon's mathematical progress; but it is doubtful if any schooling obtainable at Cockermouth was equal to his own unaided exertions, backed as they were by his father's daily encouragement. Though living by the operations of his loom, John Fallows was a man

of superior intelligence and worth; and rather than see his promising son falter by the way, actually devoted the few spare hours at his disposal to advance his own education, with the view of enlarging his son's. After advancing so far with arithmetic and algebra, Latin authors engaged them. The greatest difficulty they had was to obtain the necessary books, for which, it is said, they were very much dependent on kind neighbours higher in the social scale than themselves.

It is highly gratifying to record such noble traits of character and perseverance in search of knowledge as were manifested day after day by John Fallows and his son Fearon, placed amid the webs and cobwebs of a dingy household, and frequently disturbed by the noise and prattle of the younger branches, mainly girls, of the family. Gay's words were applicable to their constant toil to keep the thatch whole over their heads:—

> "Ye weavers, all your shuttles throw,
> And bid broadcloth and serges grow;"

for they worked with a will almost imperative to the maintenance of life itself. Then came the pleasant alternative of study in the evenings, which would have been doubly sweet had their limbs and general vigour not been reduced below par by their long hours at the loom. Amid all their trials, there was no praying to Jupiter for help; the Fallows had the good sense to know that God only helps those who help themselves. They set to work in the spirit that has always overcome difficulties, by practising a faithful diligence and purpose. Who could have looked without emotion upon these joint-heirs of industry contending with undaunted energy against the stream

of events besetting their path towards the goal of knowledge.

The best part of his education, in addition to his father's help, was obtained at the loom, the practice of the weaver's art being by no means so unfavourable to study, inasmuch as a great portion of the work is done automatically. Much Latinity was conned over, and many hard problems in geometry got solved, it is believed, by Fearon Fallows in this way. His persevering efforts to acquire knowledge remind one of Dean Milner's youthful experiences and hardships. Fallows and Milner may be said to have formed historical parallels. Both were weavers, and practised that calling up till manhood; both made companions of their books at the loom, where they studied with profit; both were actuated by the same spirit of emulation to rise above the poverty of the shuttle; and eventually their efforts were rewarded by their becoming first-class mathematicians at Cambridge, where, if anywhere in Britain, mathematical knowledge is fairly tested, and, when proved to be of a high order, as handsomely rewarded.

John Fallows having become parish-clerk at the neighbouring church of Bridekirk, the extraordinary acquirements of his son Fearon naturally reached the ears of the Rev. Mr Hervey, the vicar. Shortly afterwards Fearon was engaged as assistant to Mr Temple, head-master of Plumbland School, only a few miles distant; and on the death of Mr Temple, the Rev. Edward Stanley, rector of Plumbland, offered the situation to Fearon, who accepted it. This was a fortunate introduction for Fallows, as the Rev. Mr Stanley, a man of superior character and discernment,

soon ascertained the young schoolmaster's worth and high abilities, and laudably exerted himself to promote his advancement. The clergy, gentry, and others in the neighbourhood, on hearing of Fearon's great promise, willingly co-operated with the Rev. Messrs Hervey and Stanley in getting up a subscription to enable him to go to Cambridge, and in the year 1809 he commenced residence as a student of St John's College.

"Whatever difficulties," remarks the Rev. R. Sheepshanks ("Memoirs of Royal Astronomical Society," vol. v. p. 404), "might have previously embarrassed Mr Fallows' career were now dissipated. At St John's, honourably distinguished (perhaps above all other colleges) for attention to the education and interests of unfriended merit, he found every assistance which could be desired,—kind friends, most able instructors, and an unlimited power of consulting books. His progress was, accordingly, rapid and successful, though directed, as was to be expected, in the line of the older English geometers, with whom he was already familiar, rather than according to that of the Continental mathematicians."

The kind support of his Cumberland friends was not quite equal to his wants at Cambridge during the third year of his residence there, and he began to doubt if his funds would permit him to finish his studies without incurring debt. Whilst brooding over this difficulty, a letter reached him one morning enclosing £100 from an unknown and munificent benefactor. Some say that Fallows never knew who his friend was; others affirm that he was a brother of one of Fallows' fellow-students, whose death occur-

ring a few years afterwards, revealed, among other memoranda, the gift of £100 to Fallows, and that this sum was paid by Fallows to the brother of his benefactor.

In the year 1813, Mr Fallows proceeded Bachelor of Arts, and was third on the list of Wranglers—Mr (afterwards Sir John) Herschel being first, and Mr Peacock (afterwards Dean of Ely) second Wrangler. Both men were of the highest eminence. Had Mr Fallows taken his degree in an ordinary year, he would most probably have been senior Wrangler, but coming in competition with Herschel, one of the greatest men of his time, and Peacock, afterwards the accomplished biographer of Dr Thomas Young, he did remarkably well to be the junior of such a trio of mathematical celebrities.

As there was no Fellowship open to Mr Fallows at his own college, he removed to Benet College as mathematical lecturer. In the year 1815, he was recalled to St John's, where he resided for some years. He was Moderator, or principal mathematical examiner, in the university in the year 1818. About this time, probably, he was ordained a minister of the Church of England.

At a meeting of the commissioners appointed by Act of Parliament for more effectually discovering the longitude at sea, held at the Admiralty the 3d of February 1820, it was proposed to establish an observatory at the Cape of Good Hope, as "likely to be conducive to the improvement of astronomy." It may be said, in passing, that the commissioners included the most learned scientific men of the day, headed by Lord Melville, First Lord of the Ad-

miralty. After official formalities, in which the Admiralty figures most conspicuously, had been got through, the observatory was established by an order in Council, dated October 20, 1820; and by an Admiralty minute of the same day, "the Rev. Fearon Fallows, M.A., Fellow of St John's College, Cambridge, was appointed to the office of Astronomer at the Cape of Good Hope." His salary was fixed at £600 a year; that of his assistant at £250 a year.

He was elected a Fellow of the Royal Society, London, in 1820. He was also a Fellow of the Royal Astronomical Society.

Mr Fallows took advantage of the few months intervening between his appointment and departure for the Cape to visit the public and private observatories of Britain, and the workshops of our most celebrated artists. He also gave his time to "the calculation of special tables, and in devising the best and simplest means of making, registering, and reducing astronomical observations."

On the 1st January 1821 he married Miss Mary Anne Hervey, eldest daughter of the Rev. H. A. Hervey, vicar of Bridekirk, and his early patron, and embarked on the 4th of May following. Mr and Mrs Fallows arrived at the Cape on the 12th August 1821.

Considering the numerous difficulties presenting themselves as to the selection of a site for his observatory, the delays occurring through the supineness of the Home authorities,* both as to the adoption of

* The office with which Mr Fallows communicated in London was the then existing "Navy Board." How this Board, a kind of *imperium in imperio* of the Admiralty, should have been permitted to regulate

a plan for the building and the furnishing him with instruments needful to carry on his astronomical labours, Mr Fallows proved his earnestness by transmitting a catalogue of 275 principal stars to the Board of Longitude in 1823. The original observations were announced at the meeting of February 5, 1824, and were ordered to be delivered to the Royal Society for preservation. They were afterwards transferred to the Royal Observatory at Greenwich. In the year 1846, the manuscripts of Mr Fallows' observations were placed in the hands of Sir G. B. Airy, the Astronomer-Royal, who undertook to superintend the reductions. Accordingly these reductions were made, and submitted to the Royal Astronomical Society (Nov. 9, 1849), and afterwards published, along with a valuable historical introduction bearing on Mr Fallows' appointment, his official work and difficulties at the Cape, in the 19th volume of the "Memoirs of the Society."

"It would appear," writes Sir G. B. Airy, "that at this time Mr Fallows' position was not very agreeable. He was residing in a hired house, of so bad a construction (as, it appears, is frequently to be found at the Cape) that on one occasion the roof and a great part of the house fell in, his family escaping injury only

the affairs of the Cape Observatory, is beyond all but red-tapeism to conceive. It might have served as the type, as it assuredly realised to the full the function, of Dickens' Circumlocution Office—"How not to do it." Like many others who came under its sway, Mr Fallows suffered greatly at the hands of this Navy Board, and he had not the good fortune to live to see it swept from the face of the earth by his fellow-Cumbrian, Sir James Graham, whose first business at the Admiralty in 1832 was to clear out the nest of drones. (See my Life of Sir James Graham," 2d vol. of this series, p. 111.)

by accidental absence. He had only inferior instruments, and was waiting vainly for large ones. The ground which he had selected as a site for the observatory—supposed to be Government property—was claimed by three private persons, and was only obtained by negotiation, to the extent of $2\frac{7}{16}$ acres, about 1823, July 6; but even then no plan for building was received. Finally, in 1824, July 17, he found it absolutely necessary to dismiss his assistant, Mr Skully, and was thus left alone."

Mr Fallows was severely tried by these untoward circumstances, and felt the worry all the more that he was so far from home and the opportunities of securing more efficient aid. The arrival of Captain Roland, who proved a valuable assistant, was so far a relief to him; and the commencement of the erection of the observatory, under Mr Skirrow, gave him fresh interest in his work. Here, again, troubles arose, owing to the theft and violence of the workmen employed on the building, which could only be met by a guard of soldiers to preserve the property and to maintain order.

In 1830, Mr Fallows was deprived of the services of his assistant, Captain Roland, and was thus "left unaided to do the best he might with a transit and mural circle." In reference to this loss, Commodore Schomberg, the principal naval officer on the Cape station, in a communication he made to the Admiralty, writes:—"Mr Fallows has always complained of want of proper assistants, and I am justified in saying that, had it not been for Mrs Fallows' efforts, some of his very important observations would have failed on different occasions, where more than one individual

was indispensably required." Mr Sheepshanks says Mr Fallows was relieved from the difficulty of having no assistant by the affection and intelligence of Mrs Fallows, who offered to undertake the circle observations while he was engaged with the transit. "A very little instruction sufficed to render her perfectly competent for this task; and the Cape astronomer had, like Hevelius, the pleasure of finding his best assistant in the partner of his affections. Some of his letters written at this time express a strong hope and confidence that he should at length be able to justify the high expectations which had been formed of the observatory, and that his work would bear a comparison in accuracy, though not in extent, with that of any other establishment."

"But the labours of the observatory were too much for a constitution already much enfeebled by previous illness. He had suffered very severely from a *coup de soleil* soon after his arrival at the Cape, while fixing the small transit; and, besides some less serious complaints, experienced a dangerous attack of scarlet fever in the summer of 1830, from which he seems never to have fully recovered. In the beginning of 1831, his health was visibly impaired, but he could not be induced to leave the observatory before the equinox. Towards the end of March, he became incapable of struggling any longer with the disease, and went to Simon's Town. But it was now too late, and he breathed his last on the 25th July 1831, in the forty-third year of his age. He was buried immediately in front of the observatory. A flat tombstone of black Robben-island stone marks his grave." Though several children were born to him, they all

died in their earliest infancy; so that his widow, who had been a true helpmate and affectionate wife, had alone to mourn his loss.

It is said that Mr. Fallows built an Episcopal chapel at Cape Town, where he regularly officiated as the clergyman; and that the Cape journals always spoke of him in highly eulogistic terms as a man of sterling worth and active benevolence. He made an annual allowance of £60 to his father and mother as long as they lived; both of them died before him. His widow inherited all he died possessed of, and afterwards took a second husband.

Mr Sheepshanks observes: "To those who were acquainted with Mr Fallows, it is unnecessary to dwell upon the integrity and simplicity of his character, or the depth and clearness of his understanding. As an astronomer he had few rivals. Perfectly acquainted with the practical and scientific departments of astronomy, he carried into the observatory the same straightforward zeal and honesty which were the distinctive features of his private character; and if his life had been spared, would unquestionably have realised the most sanguine expectations of his friends and admirers.

"Mr Fallows did not leave his observations completely prepared for publication, but so nearly so as to require very little additional labour. His wish was to have had them printed under his own eyes, after they had been examined and approved of by competent judges in England, for which purpose examined copies were transmitted by him to the Lords Commissioners of the Admiralty.

"In the *Philosophical Transactions* for 1822, page

237, is a paper by Mr Fallows, 'Communication of a Curious Appearance lately observed upon the Moon.' (The original of this paper is at the Admiralty.) It gives an account of the observation of some luminous points near the moon's eastern limb, apparently in the same position in which light has been seen by other observers.

"In the *Philosophical Transactions* for 1824, page 457, is a 'Catalogue of nearly all the Principal Fixed Stars between the Zenith of Cape Town and the South Pole, reduced to the 1st of January 1824,' with a description of the instruments employed. This is the catalogue to which allusion is made above, as having been announced at the meeting of the Board of Longitude on November 6, 1823.

"In the *Philosophical Transactions* for 1830, page 153, is an account of observations made with an invariable pendulum at the Cape of Good Hope. These observations were made between November 23, 1828, and January 22, 1830, by Mr Fallows, Captain Ronald, and Mr Johnson (now Radcliffe observer at Oxford), in an outhouse near the Cape observatory."

Allusion was made in a previous page to the difficulties surrounding the path of Mr Fallows at the Cape; and it is pitiable to think that so much of his time and intellectual strength were wasted in making observations with imperfect instruments. On the 7th November 1830, he gives expression to his feelings in a note which is printed in Sir G. Airy's introduction (*loc. cit.*, p. 26) to Mr Fallows' astronomical work. It appears that the mural circle furnished him in the year 1826, but not fixed in its place till 1829, proved very unsatisfactory; nor could it well be otherwise,

as on being brought to London and examined by the Astronomer-Royal and Mr Simms in the year 1840, they found to their astonishment "that the steel collar of the large pivot was loose, having been attached merely by soft solder." (See Report of the Astronomer-Royal to the Board of Visitors of the Royal Observatory, June 5, 1841.) This pivot proved a sad stumbling-block to Mr Fallows, and tended, along with his want of assistants, and other troubles, to bring him to a premature grave.

On April 13, 1832, the Royal Astronomical Society was favoured by a communication "On the Figure of the Mural Circle at the Observatory of the Cape of Good Hope. By the Rev. R. Sheepshanks, M.A., Fellow of Trinity College, Cambridge; with an Appendix by G. B. Airy, then Plumian Professor of Astronomy in the same University." (See "Memoirs of the Royal Astronomical Society," vol. v. p. 325.) At page 407 of the same volume, Mr Sheepshanks records that Mr Fallows' work at the Cape consisted "of about three thousand transit and several hundred circle observations, with six microscopes, and some series with the invariable pendulum." These observations were reduced by the Astronomer-Royal, as mentioned in a previous page.

Among other tributes paid to the memory of Mr Fallows may be quoted that of Dr Peacock, the Dean of Ely ("Life of Dr Thomas Young," p. 448)—"The late Rev. F. Fallows, the contemporary of myself and Sir John Herschel at Cambridge; an excellent mathematician, and a very zealous and skilful astronomer, who lost his life in attempting to carry on the business of the observatory at the Cape, whilst

labouring under the effects of a severe attack of fever."

On the north side of All Saints' Churchyard, Cockermouth, are two tombstones to the family of Fallows, one of which is here quoted, recording the deaths of John Fallows and his wife, and their son, Fearon Fallows:—

"Here lie the remains of John Fallows, who died the 19th October 1826, aged 66; also of Rebecca, his wife, who died 12th January 1828, aged 69 years.

"The Rev. F. Fallows, M.A., F.R.S., &c., late Fellow of St John's Coll., Camb., H.M. Astronomer, their son, died at the Cape of Good Hope, 25th July 1831, aged 43 years. This stone is erected to their memory by the widow of the late Rev. Fearon Fallows."

ROBERT RIGG,

CHEMIST.

"*Scientia experimentalis a vulgo studentium penitus ignorata; duo tamen sunt modi cognoscendi, scilicet per argumentum et experientiam* (the ideal path and the path of experiment). *Sine experientia nihil sufficienter sciri potest.*"—ROGER BACON.

BURGH-BY-SANDS, the chief village of the barony of Burgh, is about five miles from Carlisle, and not far distant from the western bank of the river Eden, and the tide of the Solway Firth. The archæologist, in tracing the Roman Wall from Carlisle to Bowness on the Solway, whether he travel by road or rail, passes through Burgh and the almost continuous village of Longburgh; and on entering upon Burgh Marsh, observes on rising ground to his left the somewhat picturesque village of Bowstead Hill, about seven miles from Carlisle. As Burgh and Drumburgh were stations on the Roman Wall, it is fair to infer that Bowstead Hill and Easton were connecting links or stations; these villages being placed on gentle eminences to the west and above the sea-level of the marsh, whose liability to inundation would have affected the integrity of any wall built upon it.

This Burgh Marsh is historically known as the rendezvous of the largest army ever marshalled under an English monarch—the Great Plantagenet, whose object was to invade and subjugate Scotland. The Fates decided otherwise. King Edward the First, though long the guest of the jolly monks of Lanercost Abbey, and nurtured on their richest viands and wines, and afterwards tended by the Bishop of Carlisle in the episcopal residence at Linstock Castle, gradually succumbed to disease, and only reached Burgh Marsh to breathe his last, in sight of the land he meant to devastate. A monument marks the spot where King Edward died.

The parochial area of Burgh is of some extent, and contains several villages, and an enterprising body of agriculturists, who are alive to the progressive character of the times, and the rising value of horseflesh and shorthorns. Here, perhaps more than in any other district of Cumberland, may be traced the lineage of resident families for several generations; all yeomen bold, who, if the ballad-maker spoke fair of them, were not disposed to hide the merits of their holdings, or the blood of their beeves, or the amount of their bank-deposits under a bushel. Thus he characterised them as invited guests to "The Worton Wedding,"—

> "But Burgh-seyde lairds bang'd aw the rest
> For braggin o' their gear."

The clanship of family alliances is strongly exhibited throughout the district, and this tends to foster social reunions and festivities in which Bacchus is made to play no inconsiderable a part. The Burgh lairds are much given to hospitality, fond of sports

and pastimes; and on the accession of a new Lord of the Manor, come forth in all their native vigour to make Burgh Races worthy of their ancient repute. A kind of saturnalia used to prevail at these races, if the ballad-maker who was present at those held on the 3d of May 1804 was true to his calling when he wrote—

> "There were smugglers, excisemen, horse-cowpers, and parsons,
> Sat higglety-pigglety aw fare a leyke."

The interest taken in these races, which occur but once in a generation, would seem to be paramount above all things in the Burgh Barony, and it is probable that Robert Rigg, the subject of this memoir, who, being twelve years of age at the time, would be one of the spectators of the races held in 1804, heard more talk concerning them than was ever vouchsafed to him of the historical data associating the noble Roman, the bold mediæval ecclesiastic or modern Border reiver, with the locality of his birth.

The family of Rigg, residing on their ancestral estate at Bowstead Hill, had long been heard of as stalwart yeomen; and here Robert Rigg was born, amid circumstances calculated to infuse vigour into his physical frame. His birthplace overlooked Burgh Marsh and the tidal wave of the Solway, and commanded extensive views of the Scottish Border, the Vale of Esk, and the mountainous ranges of Nithsdale.

Robert Rigg, born June 3, 1792, was the third son of Robinson and Jane Rigg of Bowstead Hill. His mother was the second daughter of Robert and Mary Peat of Seaville, a well-known yeoman family in the

Abbey Holme. As Robert Rigg's ancestors were yeomen on both sides of the house, he was, in the language of the district, a thorough-bred one.

Mr and Mrs Rigg, it appears, had some difficulty in getting their large family of seven sons educated at home. Owing to the decline of the Grammar School at Burgh, to which the lads of the district were sent, Robert and his two elder brothers received part of their early education under the Rev. Mr Milner, curate of the parish of Burgh-by-Sands. They were afterwards transferred to Green Row School in the Abbey Holme, where such numbers of youths belonging to Cumberland, Westmoreland, and Lancashire received, under the direction of Mr Saul,* a capital training, fitting them for every walk of English life, commercial and professional. Young Rigg imbibed the spirit of the school, and did justice to Mr Saul's teachings, by giving early signs of real promise.

The Rev. Robinson Rigg, of Norwich, from whom I derive the few facts upon which this part of the memoir is based, thus speaks of his brother Robert: —"After he left school, it was proposed by his parents that he should be instructed in the manufacture of linen,† &c. Here his natural abilities

* Mr Joseph Saul was a Quaker, and one of the ablest schoolmasters of his day. He was also a classical poet, and an ardent "Blue" in politics, being one of Curwen's ablest lieutenants in every cause that the Workington squire espoused, be it agricultural, parliamentary, or philanthropic. His worthy life and meritorious public endeavours deserve more than this passing allusion. As a schoolmaster, who developed the character of the boys under his charge, and gave a manly bearing and direction to their studies, he had no competitor in Cumberland.

† Burgh was at one time noted for its manufacture of candlewicks, linen, and tobacco.

enabled him to improve the mode of preparing certain articles. In 1814, his eldest brother having commenced the brewery business at Whitehaven, Robert soon joined him: then was the turning-point in his mode of life and pursuits." Thus the operations of malting and brewing seemed to have created in him a new interest—that of chemistry, which he pursued with great energy and perseverance. "Circumstances then arose which led him to relinquish the business of brewing," and he returned home to reside with his mother (who had become a widow) and two of her younger sons. "Here," continues his brother, "he pursued his investigations and experiments, with an assiduity which made his relatives anxious. In every corner of the house, which, arising from its peculiar structure, afforded various recesses, were to be found experiments of one kind or another; and many a fault was found, but he persevered."

A younger brother, Joseph, having accepted the curacy of St John's, in the Waterloo Road, London, Robert Rigg was induced to seek a more congenial field for his chemical labours in the metropolis. This was in the year 1823 or 1824, and shortly afterwards he entered into an agreement with Messrs Burnett, vinegar manufacturers, Vauxhall, which proved advantageous to both parties. This and other chemical engagements enabled him to assist his younger brother and two cousins in their wish to study at Cambridge, from whence they entered the ministry of the Church of England.

In January 1834 he married Miss Anne Maria Perry, the orphan daughter of Samuel Perry, Esq., of London. This happy union did not last more than

seven months, as Mrs Rigg died of cholera in August of the same year—a severe trial in every way to the bereaved husband.

From the year 1835 and onwards, he gave his undivided attention to organic chemistry, and spent the whole of his time in his chemical laboratory. The results of his various investigations were from time to time furnished to the world of science. His first essay, entitled "Experimental Inquiry into Fermentation," was communicated to the Royal Society in the year 1836, through the kindness of his friend Mr Brande, the distinguished chemist.

After four years of too assiduous application, his health gave way, and he was obliged to retire to the country. Previous to leaving London he had, in April 1839, been elected a Fellow of the Royal Society, to which Society, from time to time, he contributed numerous scientific papers.

In July 1841 Mr Rigg removed from Chatham Place, Walworth Road, to Greenford Hall, Middlesex, where he resided the remainder of his life; and up to 1844 busily engaged himself with his experiments and writing out the manuscript of his book entitled "Experimental Researches, Chemical and Agricultural, showing Carbon to be a compound body, made by Plants, and decomposed by Putrefaction." He continued his chemical researches, and meant to publish a work "On Analysis," but his failing health did not permit him, and soon afterwards he abandoned science. After a short illness Mr Rigg passed away on the 26th February 1861, in the 60th year of his age, and was interred at Greenford Church, Middlesex.

The few observations here advanced relating to Mr Rigg's personal history contain the gist of the Rev. Robinson Rigg's communication to myself on the subject of this memoir, excepting some short prayers which the chemist had entered in his diary, and which tend to show that he was a pious, God-fearing person, who sought heavenly aid on all occasions of doubt and difficulty, and felt persuaded that his prayers were heard. Of his social circle and habits, or his inner life and character, I have no information to guide the reader, but this may perhaps be deemed of less moment compared with a knowledge of his works, a list of which is here subjoined.

List of papers published by Robert Rigg, F.R.S. (from the Royal Society's catalogue of scientific papers):—

1836. Royal Society Proceedings, iii. pp. 67–69. Experimental Inquiry into Fermentation.

1836. Royal Society Proceedings, iii. 408, 409. On the Chemical Changes Occurring in Seeds during Germination.

1837. British Association Reports, 1837, Part ii., pp. 50, 51. Investigations into the Decomposition of Vegetable Matter.

1838. Philosophical Magazine, xii. pp. 31–34. On a Method of Analysing Organic Compounds.

1838. Philosophical Magazine, xii. pp. 232–235. On a Method of Analysing Organic Compounds.

1838. Philosophical Transactions, 1838, pp. 395–402. An Experimental Inquiry into the Influence of Nitrogen on the Growth of Plants.

1838. Philosophical Transactions, pp. 403–408. On the Evolution of Nitrogen during the Growth of Plants.

1839. Royal Society Proceedings, pp. 130, 131. On the Formation of Alkaline and Earthy Bodies in Plants.

1839. Royal Society Proceedings, pp. 148, 149. On the Influence of Nitrogen as Promoting Vegetable Decomposition.

1839. Royal Society Proceedings, pp. 149–151. On Vinous Fermentation.

1839. Royal Society Proceedings, p. 165. On the Formation of Alkaline and Earthy Bodies.

1843. Royal Society Proceedings, p. 472. A Statement of Experiments showing that Carbon and Nitrogen are Compound Bodies, and are made by Plants during their Growth.

1844. British Association Reports, Part ii., p. 33. Experiments on the Formation or Secretion of Carbon by Animals, the Disappearance of Oxygen and Hydrogen, and the Generation of Animal Heat during the Process.

1844. Royal Society Proceedings, pp. 509, 510. Experimental Evidence in Support of the Secretion of Carbon by Animals.

1845. Royal Society Proceedings, p. 560. On the Formation or Secretion of Alkaline and Earthy Bodies by Animals.

1846. Royal Society Proceedings, pp. 628, 629. Experiments on Animal Temperature, showing that there must be some Source of Animal Heat besides the Carbon and Hydrogen contained in the Food of Animals.

As the scientific chemist will alone feel interested in the published essays of Mr Rigg, I need only say a few words to the non-technical reader of this memoir. The great strides made in organic chemistry of late years have superseded much that was written on this subject thirty years ago; and it is to be feared that, in this revolution of the science, Mr Rigg's work has suffered considerably in value. His earlier papers on fermentation, and the chemical changes occurring in seeds during germination, &c., contained information more or less novel and suggestive. The same praise can hardly be bestowed on his researches into the nature of carbon, which he maintained, contrary to every opinion on the subject, to be a compound body, without, however, affording any tangible data upon which to satisfy his chemical contemporaries as

to the correctness of his views. Whilst Mr Rigg was engaged on this inquiry, my lamented friend, Dr Samuel Brown, of Edinburgh, was devoting his marvellous genius to the elucidation of carbon and cyanogen, and would gladly have welcomed any attempt to throw light on the nature of the first-named elementary body; but I never remember his alluding to Mr Rigg's researches; nor is there, as far as I am aware, any reference to them in his (Dr Brown's) printed works.

Mr Rigg's views were opposed to those expressed by Liebig in 1840 ("Chemistry in its Application to Agriculture and Physiology"), and the more careful observations of Boussingault, set forth in 1844 in his valuable work, "Economie rurale considérée dans ses rapports avec la Chimie et la Météorologie." Nor do I find any reference to his researches in several Cyclopædias within my reach. This cannot have arisen from any want of publicity being given to his labours, as his essays appeared in the Proceedings of the Royal Society, and the British Association Reports, &c. His octavo volume on carbon (already referred to as his last work in page 184) was issued in 1844, a most favourable time for receiving the attention of chemists; for then public discussion was rife on Liebig's views, and the general accessions which were being made to the cause of organic chemistry both at home and abroad. Mr Rigg's volume on carbon, contains 264 pages (Smith, Elder, & Co., 1844), some of which I had marked for quotation; but the fear of obtruding technical details upon the general reader induces me to offer only an extract from the last page of this work:—

"These different forms of the putrefactive fermentation, I cannot attempt accurately to describe. I would only remark, that, in them all, the compound nature of carbon is evidenced, as well by its own disappearance, as by the increased quantity of hydrogen and oxygen, and the presence of miasm; that the increase of hydrogen, when compared with the increase of oxygen, is generally, if not always, in a higher proportion than that in which they form water; that miasm is a body highly endowed with power to favour or induce that chemical action by which it is formed; that each putrefactive process has its own miasmatic product, differing in some respects, but all agreeing in their intimate connection with hydrogen. And I might add here, that my observations during the whole course of my experiments, have led me to the conclusion that, of the elements, carbon, hydrogen, oxygen, nitrogen, sodium, potassium, calcium, &c., which constitute the organic and inorganic parts of plants, hydrogen is the only ultimate element, the rest being all compound bodies, and to question the compound nature of hydrogen."

JOHN FLETCHER MILLER,

METEOROLOGIST AND ASTRONOMER.

"*Every acquisition, won by investigation, is merely a step to the attainment of higher things in the eventful course of human affairs.*"—HUMBOLDT.

HAT of the weather? is the common salutation of John Bull, and upon its manifestations he places many hopes and fears bearing upon his pleasures or his profits in life. The physical geography and insular position of Britain, liable to every current of wind or wave affecting the northern seas, cause the atmospheric phenomena around our islands to assume an ever-varying character, with, however, a vastly larger share of the pluviose than the sunny in our skies. The weather is the great topic upon which all Englishmen have something to say, however indefinite and ambiguous their sayings may be; and at times it almost vies in interest with the gossip and scandal prevailing within every parochial bound. Even youthful lovers, if they are, to use Rosalind's words, "gravelled for lack of matter," talk of the weather, when they might more pleasantly occupy their fast-fleeting hours by acting on her happy

counsel to Orlando. And "the lean and slippered pantaloon of age," in the midst of his aches and pains and doting thoughts, will creep from the warm ingle-nook to the door to see what the weather is like, and then babble for long over its character as well as the green fields. This weather-temperament, so tangible in the English mind, is not so unreasonable, inasmuch as the health, the necessities, and the comforts of the lieges are very much dependent on the nature of the seasons. Yet, with all the thought bestowed on the indications of the weather, there is much more to be learned than has hitherto been gained on the subject.

The rise and fall of the barometer, taken in conjunction with similar conditions of the thermometer; the direction and force of the wind; the character and formation of the clouds; the rising and setting sun, or the changes in the moon; the amount of dew and mist; the clearness or obscurity of the mountain-tops; the lowing and general attitude of cattle; the flight and song of birds; the buzz of insects and their early hours; and other natural phenomena, claim the attention of different observers with variable prognostic results. And with the creeping on of age there generally arises a belief in our weather-wisdom, yet that wisdom is no great thing at the best.

It may readily be conjectured that, from a remote antiquity, the weather, even in the favoured regions bordering the Mediterranean, claimed more or less attention. Aristotle had his say on the subject, and so had his Greek and Roman disciples; but all was chimerical till Toricelli, in the year 1643, measured the weight and pressure of the atmosphere; and

Fahrenheit, in 1720, gave us the power of comparing the temperature of the air in different seasons and countries—the most important of all the elements in solving climatic conditions.

One of the greatest advances in meteorology, constituting, indeed, an era in its history, was the publication of Dr John Dalton's meteorological essays in 1793. (See the fifth volume of this series of "Cumberland Worthies.") This most distinguished chemist was not only an acute and patient observer of the various phenomena daily presented by the atmosphere, but possessed of a philosophic spirit that gave breadth and fulness to the subject of his investigations. He raised the science of meteorology from its speculative and fanciful surroundings to the sober region of the inductive methods. Spending the first twenty-six years of his life in Cumberland and Westmoreland, where *Jupiter Pluviosus* too often reigns as an unmerciful deity, he benefited by the example of the very few who preceded him in this line of inquiry, and gave much attention to the construction of rain-gauges, with the view of arriving at some definite notion as to the seasons most prolific in rainfall. Although conversant with the northern spates or rain in torrents, he little fancied in his home at Kendal that he was within walking distance of a particular region in the Lake District, where the rainfall rivalled in quantity that met with in tropical climates. This novel and highly interesting fact, showing the prevalence of a rainy season in our temperate zone that had hitherto been looked upon as exclusively met with in Southern India, only came to be known after Dalton's decease, and the credit of

discovering it is entirely due to the patient researches of John Fletcher Miller of Whitehaven—the subject of this memoir.

The ancestors of John Fletcher Miller were of Scottish extraction, and for many generations had the advantage of enjoying a good position in the world. In the possession of an unbroken genealogical tree of three centuries, they were not without a faithful endeavour to maintain it in all its integrity. The worthy position they occupied in the northern metropolis lost nothing in character by the transference of one branch of the family to Whitehaven a century ago. Of their history north of the Tweed, it is not needful to offer more than a few words of introduction.

Mr William Miller, the great-grandfather of the subject of this memoir, held office at Edinburgh as Superintendent of the Gardens and other Crown property. He was the author of a valuable work on Horticulture, and lived in the old Abbey House, in proximity to the Palace of Holyrood, which house was taken down about thirty years ago to improve the approach to the royal residence. Mr Miller was known to be a stanch adherent of the Stuarts, and his house was accordingly searched for Prince Charles, the Pretender. A band of soldiers entered at night, and George, only three years old, the son of Mr Miller, was lifted out of bed; and with such wonderment did he look upon the red coats, the glitter and lamps around, that he at once awoke to a new sense, that of memory; the impression upon which, it is hardly needful to say, was as lasting as life itself. This George Miller was sent along with his eldest brother,

Joseph, to a school of some note at Kendal, Westmoreland, and, of course, had to make the journey of nearly 150 miles on horseback. George returned to Edinburgh, not long after which, the death of his father occurred; and in 1764 he settled in Whitehaven, where he lived to the patriarchal age of ninety years, having been an honoured resident in the town of his adoption sixty-nine years. He was distinguished by his kindness of disposition, his benevolence, and courtesy of manner. In the year 1771, he was married to Mary Sibson of Lancaster, a person of superior mind and refinement, and the daughter of an old Quaker family of that place, by whom he had nine children. His second son, William, the father of John Fletcher Miller, had the benefit of a good classical education, and was a man of great energy and praiseworthy character. The urbanity of his manners, his excellent judgment, and large sympathies, made his society and advice much sought. In the year 1815, Mr William Miller married Mary, the only daughter of John Fletcher of Greysouthen, a village situated between Cockermouth and Workington. By this truly amiable spouse he had a family of four sons and five daughters. The eldest son, born at Whitehaven on June 20, 1816, and named after his grandfather, John Fletcher, is the subject of this memoir.

William and Mary Miller were highly esteemed members of the Society of Friends. Their superior intelligence and worth, along with the exercise of a large and generous hospitality, made their house in High Street not only the rendezvous of all the leading Quakers who visited Whitehaven, but of a large social

circle distributed through the western division of the county of Cumberland. Now, among the varied constituents of English middle-class life met with in the northern counties at the beginning of this century, no order of citizens were better educated, or showed more aptitude for business, or greater willingness to aid in works of practical utility and philanthropy, than "Friends." As a rule, they were in advance of the times, owing, it may be inferred, to their home and scholastic training, in which historical and general knowledge were fairly blended with an aim to worldly success and the exercise of a practical Christianity. Mr William Miller was one of the leading men of the Society that contributed its part, both in season and out of season, to enlighten public opinion on all questions of social and political interest, and in the promotion of these services failed not to claim the good opinion of his fellow-citizens. Then his home-circle, so happily directed by his affectionate wife, included a large family alliance and numerous friends occupying good position in the neighbourhood, so that whatever benefit might flow from a cultured provincial society was available to their oldest son, John Fletcher Miller. Here it may be remarked, that Mr William Miller, inheriting the longevity of his family, died in his eighty-ninth year. Mrs Miller, his widow, still lives at Whitehaven, in the possession of all her faculties, and able to enjoy with interest the perusal of historical works, and not less ready to promote the social amenities of life.

John Fletcher Miller was sent to Kendal School, the one that Dr John Dalton and his brother

Jonathan had made so worthy of regard among Friends, and which was then under the good management of Mr Samuel Marshall. There he acquired a sound classical and mathematical education, and would seem to have become imbued with a feeling for natural philosophy, the principles of which, admirably set forth by the Daltons, still held place in the curriculum of study in the Kendal institution.

Young Miller early manifested a love for science, and more particularly for that of medicine. His penchant for chemistry, botany, and the study of animated nature, indicated the desirability of his making medicine his professional walk, for which pursuit he was in so many ways well qualified. Unhappily for the carrying out of this project, that was no less his own wish than that of his parents, his health became impaired to a degree that seemed quite incompatible with the arduous labours demanded of a practitioner of the healing art. Under these circumstances he turned his attention to literature and natural science, and sought to improve his knowledge of Latin and Greek, making modern languages, especially French and Spanish, a marked feature in the programme of his self-imposed studies.

METEOROLOGICAL WORK.

Possibly influenced by the great example of Dalton, Mr Miller commenced, at the age of fifteen, a local meteorological register, which was continued, almost uninterruptedly, up to the period of his death. In this register he recorded the weight and temperature of the air, the fall of rain, and the

force and direction of the wind. After a few years' trial of the simpler meteorological methods, he commenced careful observations on the absolute amount of surface evaporation, which was measured daily for many years; the determination of the dew-point, both by observation and empirically; the radiation of heat from the earth's surface at night, and the radiating powers of various substances placed thereon. He investigated each of these departments of meteorology by an extensive series of experiments; and the results, with his comments thereon, and conclusions deduced from them, were embodied in a series of essays furnished by him to the "Philosophical Transactions" of London and the "Edinburgh Philosophical Journal."

In the year 1844, Mr Miller began, at his own expense, a very extensive series of experiments "On the Fall of Rain in the English Lake District," and for many years had between twenty and thirty rain-gauges in operation. Early in 1846 he extended the inquiry to the mountains, with the view of ascertaining the gradation and amount of atmospheric precipitation at various heights above the sea-level, up to the highest attainable elevation in England.

As these investigations proceeded, Mr Miller remarks,* "Some remarkable results were elicited, which, coming to the knowledge of the Royal Society early in 1847, the Council kindly expressed a wish to contribute from the donation fund † the

* Introduction to his first communication made to the Royal Society, read May 18, 1848.

† The Royal Society looked upon these meteorological inquiries as of such deep interest that they granted Mr Miller further sums towards

sum of £20 towards the current expenses attending the inquiry. The donation was accompanied by a request, that as early as convenient after the close of the then current year, I would transmit to the Royal Society a *resumé* of all that I had done in this department of meteorology. This *resumé* I have endeavoured to communicate to the Society in the annexed paper, entitled—'On the Meteorology of the Lake District of Cumberland and Westmoreland, including the results of Experiments on the fall of Rain at various heights above the earth's surface, up to 3166 feet above the mean sea level.' This essay was read, by Colonel Sabine, to the Royal Society on May 18, 1848."

After a paper has been communicated to the Royal Society, the usage is to refer it to a Committee of Fellows, to judge as to the propriety of its publication or non-publication in the Transactions of the Society. One of the referees on Mr Miller's paper was the late Professor Phillips, the eminent geologist, from whose report the following excerpt is taken:—"This communication relates essentially to the quantities of rain falling on a surface of variable elevation and suddenly changing form, and contains on this subject the most valuable and interesting results which have been collected respecting any part of the British Islands. I recommend that the tables be

the defrayment of the heavy annual expenditure incurred by him. Nor was private aid wanting to promote these experimental investigations; and among those who gladly contributed to this purpose may be named the eminent engineers Robert Stephenson, J. M. Rendell, William Fairbairn, James Simpson, Thomas Hawkesley, and J. F. Bateman. (*The Patent Journal and Inventor's Magazine*, January 26, 1850).

printed entire, and all the annotations explanatory of the method and circumstances of the research, and the deductions or attempted deductions from the phenomena."

Accordingly, Mr Miller's essay was honoured by being published in the "Philosophical Transactions," Part I., for the year 1849, with all his tables and explanatory remarks. No summary can well be offered of a series of observations so numerous as Mr Miller records; but a few passages may be quoted from his annotations, as showing the views he entertained on various meteorological phenomena.

Here is Mr Miller's opinion on the height of the clouds:—

"The late Mr Crosthwaite, of Keswick, by means of marks on the side of Skiddaw, and with the assistance of a telescope at his residence, made two or three daily observations on the height of clouds for several years; and it is clearly proved by his tables that the clouds are lowest in the three first and three last months of the year. Moreover, Dr Dalton affirms, in his 'Meteorology,' that the clouds are seldom a mile high (or little more than one and a half times the altitude of Sca Fell) in this climate in winter. Now, the Doctor here probably alludes to, or at least includes, the most elevated clouds, such as the cirri, and some varieties of the cirrostratus. But there can be no doubt that between the months of November and March the under surface of the nimbus, or rain-cloud (the lowest except the stratus), is *far* below the tops of our highest mountains, and I have reason to believe, not unfrequently, its upper surface also; when this is the case, the gauges on Sca Fell, Gable, &c., will receive no rain at all, when it is descending abundantly in the valleys beneath. I have a well-authenticated instance of such an occurrence even in the middle of summer. On the 5th of July 1846 (the hottest day in the year) this county was visited by a dreadful storm of thunder, lightning, hail, and rain, which continued from two to half-past four o'clock in the afternoon.

Two gentlemen who happened to be on the top of Skiddaw during this storm state that, whilst the rain was pouring down in torrents in the valley, not a drop fell on the summit of the mountain. In this elevated position the sky was clear, and the atmosphere calm and untroubled, when below them the elemental war was raging with the most terrible fury. The spectators describe the scene as awfully grand beyond conception. The lowness of the rain-cloud at this season is, I apprehend, the principal cause of the small quantity of rain, in proportion to the valley, during the winter as compared with the summer months."

Writing of the currents of air, and the moisture they convey, he states :—

"The warm south-westerly current arrives at the coast loaded with moisture obtained in its transit across the Atlantic. Now, our experiments justify us in concluding that this current has its maximum density at about 2000 feet above the sea-level; hence it will travel onward until it is obstructed by land of sufficient elevation to precipitate its vapour; and retaining a portion of the velocity of the lower parallel of latitude, whence it was originally set in motion, it rapidly traverses the short space of level country, and with little diminution of its weight or volume; but on reaching the mountains, it meets with a temperature many degrees lower than the point at which it can continue in a state of vapour; sudden condensation consequently ensues in the form of vast torrents of rain, which in some instances must descend almost in a continuous sheet, as when nine or ten inches are precipitated in forty-eight hours.

"When we reflect that a warm moist current, perhaps only 3° or 4° above the point of saturation, in coming in contact with the mountain ridge probably meets with a stratum of air 10° or 15° lower than its own inherent temperature, we shall cease to marvel that such quantities as four or five, or even six, perpendicular inches of water should be deposited in these localities in the course of a few hours. The mountains are, in fact, huge natural condensers, destined to force from the atmosphere the mighty volumes of water requisite for the supply of our lakes and rivers."

His second essay, read to the Royal Society, April 19, 1849, affords the following quotations, showing his views on the temperature of the Lake District, and how this is modified by the physical character of the locality :—

"*Temperature.*—The mountain valleys are commonly supposed to be intensely cold, particularly in the winter season ; but the thermometer, so far from countenancing this opinion, shows that the inhabitants enjoy a milder and more equable climate than those who reside in the open country. The town of Whitehaven, from its proximity to the sea on the west coast, is well known to have a much higher mean temperature than is due to its latitude ; it is also much less subject to those great and sudden fluctuations of heat and cold to which inland places are liable. Yet the mean temperature at Seathwaite, in the heart of the Lake country, is only about 1·5° lower than with us. In 1847 and 1848 the mean temperature of Seathwaite was 47·46° and 47·10°, whilst at Kendal it was 46·67° and 46·32° respectively.

"In winter, the mean of the night temperature is several degrees higher than at Cockermouth in the open plain, where the frost is much more severe. The indications of the thermometer are in accordance both with the assertions of the residents and with my own observation ; for in travelling to the lakes, where the roads over the commons were frozen hard, I have often found them quite soft and clammy on arriving amongst the hills.

"These valleys not only have a higher winter temperature than many localities greatly to the south of them, but they very rarely experience those low extremes which not unfrequently occur in the southern counties of England. The mean temperature of the winter months at Chiswick, in Middlesex, is nearly the same as in the Lake District, whilst a much greater extreme of cold is frequently felt there than in the north. In the neighbourhood of the metropolis, the thermometer sometimes indicates a degree of cold almost unknown in these districts. Thus, on the night between the 11th and 12th of February 1847, the temperature at Greenwich fell to 6°, at Chiswick to 4°, and at Uckfield,

Sussex, to 1°; when at Seathwaite the minimum was 24·5°, and the minimum for the month 20°.

"The lakes, by absorbing heat in the summer and giving it out in the winter months, added to that radiated from the rocky mountain breasts, and, above all, the caloric evolved in a sensible form by the condensation of such enormous volumes of vapour, no doubt tend greatly to modify the climate of these sequestered localities."

In reference to the mountain gauges, he found the results obtained in 1848–49 were in strict accordance with those of the two previous years, confirming his previously-expressed opinion, "that the quantity of rain increases from the valley upwards to an altitude of about 2000 feet, above which it begins to diminish." Thus, in thirteen months—

			Inches.
The Valley, 160 feet above the sea, has received			127·47
Stye Head, 1290	"	"	138·72
Seatollar Common, 1334	"	"	139·48
Sparkling Tarn, 1900	"	"	148·59
Great Gabel, 2925	"	"	91·32

His third essay, read to the Royal Society, May 30, 1850, was "On the Relation of the Air and Evaporation Temperatures to the Temperature of the Dew-Point, as determined by Mr Glaisher's Hygrometrical Tables, founded on the Factors deduced from the Six-hourly Observations made at the Royal Observatory, Greenwich."

"The subject of evaporation has been very little investigated or treated of since the publication of Mr Howard's 'Climate of London' in the year 1818; and having paid considerable attention to this department of meteorology for several years past, I may perhaps be excused (though not directly connected with the issue of this paper) from briefly giving the results of my own investigations, obtained at nearly the opposite point of

the kingdom. Evaporation is scarcely ever entirely suspended, either during the heaviest rains or when the air is completely saturated with vapour—at least, I have not met with more than two or three instances in which some daily loss was not appreciable to a finely graduated metre. In severe droughts the depth evaporated in twenty-four hours will sometimes, though very rarely, reach four-tenths of an inch. On the 22d of May 1844, 0·430 was measured; and on a freezing mixture being applied to Daniel's hygrometer, the dew-point was found to be 24° below the temperature of the air, which was 63°. The evaporation for the month was 6·280 inches, with only a quarter of an inch of rain."

After giving tables showing the amount of evaporation at Whitehaven in the six years ending with 1848, he goes on to say:—"The mean amount of evaporation for the six years is 30·011 inches, and the average quantity of rain for the same period is 45·255 inches; so that the depth of the water precipitated exceeds that taken up by evaporation at the coast, in the latitude of 54½°, by 15·244 inches."

On May 30, 1850, and March 13, 1851, Mr Miller read essays to the Royal Society "On the Meteorology of the Lake District," embracing the usual tables of rainfall, &c., and his comments thereon. The publication of these in the "Philosophical Transactions" stamped their high character for originality.

In the year 1850, Mr Miller became a candidate for the Fellowship of the Royal Society, under the new and stringent regulations of 1848. His certificate of application was signed by Sir John Herschel, Sir G. B. Airy, Sir T. M. Brisbane, Admiral Smyth, Professor Challis, and other men of high distinction; and his election was at once secured, June 6, 1850.

Mr Miller states that the experiments on the rainfall in the Lake District valleys were commenced in 1844, the mountain gauges were planted in the spring of 1846, the hygrometrical observations were instituted at the beginning of the year 1852, and the entire investigation was brought to a close at the end of the year 1853, when its main objects were considered to have been satisfactorily answered and attained.

The tabular observations and general results of the inquiry up to the close of the year 1850 were made known to the Royal Society of London in four papers, as already stated. The fifth and concluding paper (comprising the observations, &c., for the years 1851–53 inclusive) he communicated to the Royal Society of Edinburgh on May 1, 1854, with the title "On the Meteorology of the English Lake District, including the Results of Experiments on the Fall of Rain, the Temperature, the Dew-Point, and the Humidity of the Atmosphere, at Various Heights on the Mountains, up to 3166 feet above the Sea-Level, for the Years 1851, 1852, and 1853."

The tables illustrative of his views filled no less than twenty-three pages quarto. Some of his remarks may interest the general reader, but the only way to comprehend the nature and extent of his observations is by an appeal to the original papers. Here are two paragraphs worth quoting:—

"The above tables show that on the mountains the greatest depth of rain invariably obtains at Sparkling Tarn, 1900 feet above the sea-level. The current which brings our principal supply of rain is the south-west. It is characterised by a high temperature—is generally at or near the point of saturation—

and, in most heavy and continuous rains, the depth of the stratum of vapour is considerable, extending from 1000 feet or less above the sea to probably 4000 or 5000 feet above it. In passing over the comparatively level tract of country between the coast and the mountain ranges, rain is deposited, but with little diminution in the temperature of the gases or vapour. The current is at length arrested in its progress by the hills—the vapour in contact with the bases of the mountains is subjected to more rapid condensation, during which it gives out a portion of its latent heat in a sensible form, whereby the temperature of the surrounding mass of air and vapour is increased, and, by virtue of its increased elasticity, it rises to a greater height; the diminution of temperature due to the increased elevation causes fresh deposition—the surrounding medium is again warmed—the vapour ascends still higher—is further cooled, and more water forced from it; and thus the same operation is continued and repeated so long as an adequate supply of vapour is furnished from beneath. Hence, in the upper regions of the atmosphere, there is a vertical as well as lateral current of vapour constantly rushing in to supply the loss by precipitation.

"In ascending from the valley, the amount of vapour which the atmosphere is capable of supporting or containing in mechanical combination is found to diminish, while the difference between the air and dew-point temperatures also gradually decreases. There must, therefore, be a point of elevation where the quantity of vapour and the degree of humidity will combine to produce a maximum deposit of rain in a given time; and this place of greatest condensation is found, in the English Lake District, at or about 2000 feet above the sea-level."

After quoting some tables and remarks of Colonel Sykes ("Discussion of Meteorological Observations taken in India," published in the "Philosophical Transactions," Part II. for 1850), showing that, at the height of 6200 feet, there were forty-six inches less rainfall than at 4500 feet, Mr Miller goes on to say—

"On comparing the above tables with those for the English Lake District, it will be perceived that the downfall of rain at Seathwaite and its adjacent mountain stations exceeds the annual receipts at most of the stations in the peninsula of India, both in the plain, and at moderate and extreme elevations on the mountain ranges, the excess in the tropical region being chiefly at Mahabuleshwar, Mercara, and Uttray Mullay, which, although differing greatly in latitude, lie nearly on the same meridian, and are all the same elevation of 4500 feet above the sea.

"In the mountain valleys of our Lake District, the greatest deposit of rain is always found at the head or eastern extremity of the dale, because the vapour on arriving there is further obstructed and confined by the high mountains surrounding it, and, being dashed against their cold rocky sides, increased decomposition ensues; and, as the remaining vapour can only escape by slowly climbing over the tops, ere the transition or deportation is effected, fresh vapour rushes in to supply the vacuum produced by condensation; and the precipitation is not only rapid, but continuous, so long as the warm saturated current continues to flow up or into the valley from the Western Ocean. In like manner, more rain is impounded on the mountain passes, and in the hollows and basin-shaped cavities on the mountains, than on their summits. In passing over the tops, the vesicles are cooled and rendered heavier, and volumes of vapour flow down into the hollows and gorges, where they are hemmed in as in a *cul de sac*, and are converted into water. As decomposition proceeds, fresh masses of mist roll down the slopes, which in their turn are condensed and precipitated by the surrounding cold high land; and, as in the former case, the fall is both copious and uninterrupted, while the vapour in its swift transit over the adjacent peaks is but partially metamorphosed into drops of rain."

In reference to EVAPORATION, Mr Miller observes:—

"The chief supply comes from those tropical regions where an unclouded and almost vertical sun is continually lifting up the waters of the ocean into the atmosphere in an invisible

form; the warm vesicular vapour thus generated by evaporation rises to a great height, and is transported by currents into our northern climate, where it descends as rain, and maintains the existence of our lakes, rivers, and springs; while the large amount of sensible heat liberated during the condensation and conversion of the vapour elevates the temperature of the mountain valleys above that of the adjacent plains in the colder months, and no doubt tends materially to modify the climate at all seasons. A cubic inch of water will form a cubic foot of steam of the same apparent temperature as the water; but during the process of conversion it has absorbed 1000 degrees of heat from the surrounding atmospheric space—of which the thermometer gives no indication till the vapour is reconverted into water, when the latent caloric is slowly evolved in a sensible form. The amount of perceptible heat yielded up annually in the formation of 141 inches of rain at Seathwaite is almost incredible, and the extent to which the climate of this naturally inhospitable region is ameliorated by this natural provision for equalising temperature must be proportionally great. The average depth of water raised by evaporation at Whitehaven in the twelve years between 1842 and 1853 is 29·664 inches, and this quantity may be accepted as the liquid equivalent of the average amount of vapour thrown off by our *lakes* in the course of a year. The real amount yielded by the *entire area* of the district is, of course, considerably less. The rainfall in the lake countries varies from 67 to 141 inches per annum. Of the 141 inches precipitated at the head of Borrowdale, probably almost 25 inches is supplied on the spot in a vesicular form; so that the mass of vapour annually imported from lower latitudes must be equal to 116 perpendicular inches of water, nearly the whole of which finds its way back again unchanged to its original source, the ocean.

"The waters of the ocean cover nearly three-fourths of the surface of the globe; and of the thirty-eight millions of miles of dry land in existence, twenty-eight millions belong to the northern hemisphere. It is computed that the depth of water raised by evaporation from the entire surface of the ocean is about four feet per annum, while in tropical seas the amount converted into vapour cannot be less than a quarter of an inch daily all

the year round, or say ninety inches annually. In the month of May, the liquid equivalent of evaporation from our lakes occasionally amounts to 0·25 inch per diem for several days together, and in extremely dry periods it sometimes, though very rarely, reaches 4-10ths of an inch in twenty-four hours. On 22d May 1844, 0·430 inch was measured, and on a freezing mixture being applied to Daniel's hygrometer, the dew-point was found at 24° below the temperature of the air, which was 63°. The evaporation for the month was 6·280 inches, with only a quarter of an inch of rain."

Mr Miller affirms that evaporation is scarcely ever *entirely* suspended, either during the heaviest rains, or when the air is apparently saturated with vapour; that it is active at very low temperatures of the air, and goes on freely from the surface of frozen water, even when the whole mass is converted into a solid block of ice. After furnishing proofs of this evaporation in 1847, 1848, and 1849, he continues:—

"Lastly, in the first six days of January 1854, the loss from the frozen contents of the gauge was 0·219 inch, or 0·36 *per diem*, which is identical with the average daily evaporation in that month. Hence it appears that, notwithstanding the large amount of heat required not only to liquefy but to vaporise frozen water, the vapour thrown off by ice in an invisible form exceeds in amount the average daily evaporation from an equal surface of water in the winter season. This apparently anomalous circumstance arises from the extreme dryness of the atmosphere, and its consequently increased capacity for vapour, in severe frosts; whereas, at other times during the winter, the air is very moist near the sea, being generally not more than 2° or 3° above the point of saturation."

The above quotations will suffice to show that Mr Miller's inquiry into the meteorology of the English Lake District brought out many highly interesting and scientific data, the results of which go to prove—

1. That we have a tropical fall of rain in the tem-

perate zone, and that in some portions of the Lake District of England the annual quantity occasionally amounts to 180 inches.

2. That the fall in a single month at several stations in the Lake District, in very wet seasons, considerably exceeds 30 inches, as was the case at Seathwaite, Gatesgarth, and Langdale Head, in December 1852.

3. That the maximum fall in twenty-four hours is nearly seven inches, and in forty-eight consecutive hours ten inches nearly. These quantities, especially the annual fall, are, it is believed, unprecedented, except on some of the mountain ranges of India.

4. The maximum fall of rain is found at or about 2000 feet above the sea-level, above which elevation the quantity rapidly diminishes.

Previous to Mr Miller's labours in 1844 there were only two rain gauges in the Lake District, one at Esthwaite Lodge, the other at Grasmere. In addition to the larger records of his meteorological work discussed in the foregoing pages, Mr Miller contributed a synopsis of his observations made at Whitehaven to the "Edinburgh New Philosophical Journal" for October 1848, January and July 1850, October 1851, January and July 1853. The local journals also benefited by his reports from time to time.

In connection with his meteorological inquiries, it may be stated here that, in the hope of benefiting his health, he left England in October 1837 on a voyage to Sydney, New South Wales, *viâ* Bahia, remaining at the former place some months. From thence he proceeded to Valparaiso, Chili, returning to England early in January 1839. His love of science was

evinced as strongly on sea as on land, for during his voyages out and home he kept up daily three sets of meteorological observations, together with a journal of all interesting phenomena, with a ship's and private journal. Previous to sailing from London he was elected a member of the then existing Meteorological Society, with a request from the Council that he would forward communications as opportunity offered.

ASTRONOMICAL WORK.

Although it is on the science of meteorology chiefly that Mr Miller has left his mark, he was much devoted to astronomy, and was well acquainted with the literature of the subject. In 1850 he built an elegant private observatory, which he furnished with a very fine equatorially-mounted achromatic refractor, of 4·1 inches aperture, and 6 feet focal length, made by the eminent opticians, Messrs Cooke & Sons, of York. The micrometrical apparatus was by Troughton & Simms. He devoted himself for some time to the micrometrical measurement of the positions and distances of a selected list of double stars; and perhaps there is no branch of practical astronomy which requires more dexterous and skilful manipulation than these measurements. The labours of Mr Miller in this department were not very extensive; but it may be safely asserted, and is admitted by those most competent to judge, that the accuracy of the results which he obtained is on a par with that of the most eminent observers.

He published some of his astronomical observations in the *Astronomie Nachrichten* (Nos. 790, 806, and 848), and in the monthly notices of the Royal Astro-

nomical Society of London. The chief results which he obtained after laborious inquiry night after night will be found in the twenty-second volume of the "Memoirs of the Royal Astronomical Society," appended to a paper by Mr Isaac Fletcher, M.P., on the "Results of Micrometrical Measures of Double Stars made at Tarnbank, Cumberland." In that paper Mr Fletcher observes—"Having had ample opportunity of seeing and using Mr Miller's apparatus, I have no hesitation in saying that it is of first-rate excellence; and the same remark is, I believe, equally applicable to the results which he has obtained."

The observatory, with its elegant revolving conical roof, still remains a conspicuous object from the new road as you approach Whitehaven. The telescope, after Mr Miller's death, was, on the strong recommendation of Mr Fletcher, purchased by Mr James Nasmyth, the celebrated engineer and astronomer, by whom it is highly prized.

Mr Miller observed the transit of Mercury, as seen at Whitehaven, on November 9, 1848; and the solar eclipse of July 29, 1851. On September 4, 1851, he had an opportunity of studying a "stupendous group of spots on the sun's disc." In February 1852 he observed Encke's Comet. These and other astronomical observations were communicated to the *Whitehaven Herald*, along with his synopses of the fall of rain in the English Lake District.

He was a frequent contributor to the *Edinburgh New Philosophical Journal*, and the July number for 1853 contains an account of a "Singular Irridescent Phenomenon seen on Windermere Lake, October 24,

1851," which he portrayed in a well-executed water-coloured drawing, that proved his artistic taste, and enhanced his description of the phenomenon.

HIS PERSONAL CHARACTER, &c.

Mr John Fletcher Miller has been characterised as a good-looking person, with a high and intellectual brow and regular facial features. His expression was generally grave and sedate, as became a faithful student of Nature; but when that expression got lighted up by conversing on his favourite subjects, he displayed much animation, and impressed every one who listened to him with a belief in his acumen and learning. He was fond of antiquarian lore, and well read in every branch of literature, and truly a student through life. His generous and liberal feeling towards others made him speak with high regard of his contemporaries in science, by many of whom he was much respected. He was a man of some humour, with a keen sense of the ridiculous; and sometimes his risible powers, when excited in this way, became intensely exalted.

His love of Nature and her works was unbounded: even the humblest flower pressed beneath his foot arrested his attention, and in all things he was fond of tracing the evidence of design and of adaptation in the works of the outward creation. His attachment to his native county amounted to enthusiasm; and great was his delight when, in his numerous excursions among the hills and mountains, he had the society of a sister or a friend to whom he could converse on the beauties around.

Mr Miller was of a refined and pure nature, un-

affected in disposition, amiable and benevolent, and possessing the warmest affections, whilst he was characterised from childhood by great love of truth and strict integrity.

Looking at his meteorological journals, one is impressed with the extraordinary neatness and methodical arrangement that guided him in elaborating his statistics, and making them worthy of public confidence. His caligraphy is strikingly beautiful, and much more consonant with the work of the engraver's art than the penmanship of a man of science furnishing figures and other details respecting the weather.

He was tall and well-built, and possessed a powerful and athletic frame. His pedestrian powers were very great. In journeying among the mountains, looking after his rain-gauges and making observations with the hygrometer, he frequently walked from twenty to thirty miles over very rough and laborious ground. On one occasion he performed a feat not often paralleled. He walked seventy miles within twenty-four hours. This was verified by careful measurement on a map. His power of continuous application to any matter he had in hand was remarkable; and it is to be feared that in the too free exercise of his nervous energy he forgot what was due to the carrying on of his organic functions; hence, probably, arose that impairment of his bodily health which at times greatly interfered with his intellectual pursuits.

After he had become a fellow of the Royal Society, he maintained a large correspondence with, and gained many lasting friendships among, the

leading men of science in Britain. When he visited Paris, he was kindly received by M. Arago and other French *savans*. Although Mr Miller died comparatively young, his assiduous exertions in meteorology and astronomy met with handsome recognition at the hands of his contemporaries, and must have helped to console him in his hours of suffering from bodily pain, and the too general prostration accompanying long-continued disease.

Mr Miller was member of several learned societies. He became an associate of the Institution of Civil Engineers in 1851, and was soon afterwards named a life associate of the Society. In addition to his being a fellow of the Royal Society, he was a Doctor of Philosophy and Master of Arts of the University of Gottingen, fellow of the Royal Astronomical Society, member of the British Meteorological Society, and corresponding member of the Literary and Philosophical Society of Manchester.

It has already been stated that in his youth he was meant for the medical profession, but obliged by ill-health to renounce the attempt. In mature life his wish to become a doctor of physic was revived, and in the year 1855 he would gladly have entered himself at Guy's Hospital, London. In the course of the following year his health became more impaired, and, after much suffering, he expired on July 14, 1856, having just completed his fortieth year. He was buried in the picturesque cemetery outside the town of Whitehaven. A simple slab of greystone, with suitable inscription, marks his grave.

It was Mr Miller's wish to follow up his series of annual papers on the meteorology of the Lake Dis-

trict, by an essay "On the Physical Geography of the English Lake and Mountain District," for which he was engaged in collecting materials in the year 1854. The object of this treatise, as he remarked, "in addition to the meteorological facts and results arrived at in the course of this inquiry [meteorology of the Lake District], and the aerial phenomena common or peculiar to mountain localities, is intended to embrace the subjects or sciences usually included under the head of physical geography—as the geology, botany, ornithology, and entomology of the district, in connection with climate and elevation; and special attention will be directed to the plants and insects (*Lepidoptera*) indigenous to the mountain regions." It is to be regretted that his life was not spared to aid in carrying out so desirable a work.

The meteorological labours of Mr Miller, it will be observed, occupy most attention in this brief memoir, and deservedly so, as they are of great value, the significance of which is daily becoming more and more manifested. The wonderful rainfall among the mountains of Cumberland brought to light by Mr Miller was received by men of science with more or less incredulity, even after the Royal Society, through the recommendation of Professor Phillips, had given honourable place to the data upon which Mr Miller founded his reports. Each year, however, tended to strengthen the correctness of his views; and since his decease in 1856, the work he originated has been diligently carried on by his cousin—Mr Fletcher, the honoured M.P. for Cockermouth. Not only has Mr Fletcher quite confirmed his predecessor's observations as to the rainfall in the Lake

Districts of Cumberland and Westmoreland, but shown from certain years, notably the wet year of 1866, that the amount of rain at times exceeds the highest figures recorded by Mr Miller. When meteorologists were accustomed to hear of something like thirty inches of annual rainfall throughout England, they might well affect surprise at Mr Miller's statements of 170 or 180 inches occurring in certain parts of the Lake District; but this excessive rainfall was considerably exceeded in the year 1866, when Mr Fletcher found a fall of 224·56 inches registered at the Stye station—a quantity which, as Mr Fletcher duly observes, "has never before been measured in Europe, and can only be paralleled or exceeded in tropical regions." Mr Fletcher has conferred a great obligation on the public by publishing from time to time a synopsis of the rainfall in Cumberland and Westmoreland, derived from nearly fifty pluviometers placed in different stations of the two counties by himself and friends willing to co-operate with him in this useful work.

In carrying out measures of public health, fresh air and pure water are the greatest of all desiderata; and if the political cry of to-day be sanitary reform, the cry of great cities is for water. Extensive works have been erected both in Scotland and England to obtain a constant supply of water from elevated sources free from human contamination; and a bolder scheme is now afloat, that of supplying the large towns of Newcastle and Gateshead on the Tyne from the Lake of Ullswater—a distance of about eighty miles. Liverpool is also discussing a

similar project to-day, and London sometimes contemplates coming to Wales, if not the Lake District, for its water-supply; and it is not improbable that these proposals, as yet more or less indefinite, may become *un fait accompli* before the end of the century.

The knowledge of 180 inches of rainfall occurring in the Lake District, as discovered by the painstaking efforts of Mr Miller, and the further researches of Mr Fletcher, may be justly considered as the basis of the projects planned or meditated by the banks of the Tyne, the Thames, and the Mersey.

SIR JOSEPH WILLIAMSON.

"The king can mak a belted knight,
A marquis, duke, and a' that;
An honest man's aboon his might,
Gude faith, he maunna fa' that?"—BURNS.

JOSEPH WILLIAMSON * was born about the year 1625, in the village or vicarage of Bridekirk, near Cockermouth. His father, the Rev. Joseph Williamson, was one of the ill-paid clergymen of that period whose worldly means and social status scarcely ranked with the yeomanry and farming-class around him. No position in life could be less enviable than that of the son of a poor Cumberland parson; yet young Williamson by his diligence, apt scholarship, and apter diplomacy of character, aided more or less by influential friends, rose from the humble-pie of a humble vicarage to one of the highest offices in the State, and the Presidency of the Royal Society.

Possessing a fair amount of classical knowledge,

* Chronologically viewed, this memoir of Williamson's should have stood first in the volume. The difficulty of obtaining information regarding his history, and the desirability of placing the preceding memoirs in one group, led to the adoption of the present arrangement.

he became the amanuensis of Mr Richard Tolson* who probably lived in the vicinity, and who, in the year 1660, represented Cockermouth in Parliament. He went to London with his patron, by whose interest he was admitted into Westminster School, then under the mastership of the famous Dr Busby. Williamson's "quick apprehension and unwearied diligence" struck Busby so favourably, that he recommended him as a northern youth deserving the kind attention of Dr Langbaine, Provost of Queen's College, Oxford, where he was admitted on the foundation. He proved himself worthy of the trust reposed in him by his patrons.

During the early period of his Oxonian life, Williamson wrote a few verses on an occasion of great interest, not only to the learned and curious of Oxford, but to the cultivators of physiology in the world at large. It arose in this way. A woman named Anne Green was executed at Oxford in the year 1650 for having murdered her illegitimate child, she protesting her innocence to her last breath on the scaffold. After hanging half an hour, and believed to be dead, she was coffined; but on the doctor's coming to dissect her, signs of vitality showed them-

* Williamson would hardly be more than sixteen or seventeen years of age when acting as clerk to Mr Tolson; and at this period Mr Tolson was not, as has been stated by some writers, M.P. for Cockermouth. Previous to the year 1640 there is an hiatus in the representation of Cockermouth, owing, it is said, to the worthy burghers desiring to be relieved of the onus of maintaining their members in Parliament, whose public services were not deemed worthy of the cost of their expenses in London. Mr Tolson, along with Sir Wilfrid Lawson, represented Cockermouth in 1660, and apparently continued to do so till 1679; but at the earliest date, namely, that of 1660, Williamson had reached an important step in the ladder of the State.

selves, and by the exertions of Drs Petty and Wills, she was recovered, and what was more, lived to prove her innocence. Oxford thus obtained a new and startling sensation, which her young wits did not fail to make use of by issuing pamphlets, poetical effusions, &c., so Williamson would try his hand in the following French verses :—

"A CEUX DE LA MESSE.

"Cà Catholique, que dis tu maintenant?
Les miracles se sont ils pas? pendant
Qu' entre nous l'aveugle gaigner la vue,
Le borteux marche, le mort se voit en rue,
Voyez la fille, qui tantôt étoit morte,
Elle vit à cett'heure, et très gaillarde se porte."

This *jeu d'esprit* was rather freely translated by a Cumbrian into the vernacular as follows :—

"Aha! good Catholic! you'll own at last
Th' age of miracles is no longer past,
When on the streets we see the lame a-walking,
The dead a-dancing, and the dumb a-talking;
Yes e'en the maid who *swung it* t'other day
All hearty now, and in a thriving way."

Williamson obtained his Bachelor of Arts in the year 1653, and shortly afterwards, on the kind recommendation of the Provost of Queen's College, became travelling tutor to an English nobleman in a tour through France and other countries. On his return he was elected a fellow of Queen's, and took his Master of Arts in 1657. It has been supposed that he also took deacon's orders for the Church.

Soon after the restoration of King Charles II., Williamson was appointed secretary to Sir Edward Nicholas, Secretary of State; and by his (Sir Edward's) successor, Lord Arlington, was placed in the State-Paper Office at Whitehall as *Custos-*

Archivorum. In this responsible position, his knowledge of Latin and French, and in part of German, served him a good purpose. In the year 1665 he appeared in a new capacity, and one that very clearly proved his determination to advance himself in the world—to win his laurels, no matter how, by blood or ink.

From the official documents in the Record Office, and now calendared, Mr R. S. Ferguson has derived information enabling him to state that Williamson "contrived to be made Editor of the *London Gazette*, which he improved very neatly, at the expense of Roger L'Estrange, the surveyor of the press. L'Estrange published a paper called the *Newsbook*, the profits of which he had always represented as *nil*, and the trouble immense. Williamson got him offered a pension of £100 a year to retire, when poor L'Estrange had to admit that he made at least £400 a year by the *Newsbook*. His pleadings were futile. Williamson compelled him to take the pension, and absorbed his *Newsbook* into his *London Gazette*. Williamson established correspondence with persons, official or private, in all the leading seaports and towns of England, and also on the Continent, and from this source he compiled his *Gazette*. He had a rival in one Muddiman, but Williamson managed to get Muddiman's correspondence intercepted in the post-office, and also stopped his supply of franks."*

The above is not a pleasant narrative to quote, inasmuch as it shows Williamson in the light of a trickster, spurring his enterprise under the seal of

* "Cumberland and Westmoreland M.P.s," by R. S. Ferguson, pp. 14, 15. (London: Bell & Daldy, 1871.)

official authority, and quite regardless of his personal character whilst professedly acting on behalf of the interests of his country. In 1667 he was appointed one of the Clerks of the Council in ordinary, and then received the honour of knighthood—a compliment highly befitting a man who had acted as unscrupulously as a border reiver.

Sir Joseph Williamson was one of the Plenipotentiaries, along with the Earl of Sunderland and Sir Leonine Jenkins, at the Treaty of Cologne.

He appears as D.C.L. of Oxford in the year 1674; and on the 27th June of the same year was appointed Secretary of State, in the room of Lord Arlington, to whom, according to the custom of that venal period, he gave £6000, in order to succeed him. He was at the same time introduced to the Privy Council. The period during which Sir Joseph Williamson was Secretary of State was one of subservience by Charles II. to the interests of France, with which power he entered into secret alliances, and of fears in the nation of the introduction of Popery into England. Sir Joseph was known to be in the hands of the king, and his actions were narrowly watched. In 1678, on a complaint from the House of Commons that commissions had been granted to Popish recusants, and warrants for mustering them into the military service countersigned by Sir Joseph, he was committed to the Tower. "This," according to the writer in Hutchinson's "History of Cumberland," "much offended the king, who the next day sent for the Commons to attend him in the banqueting-house, Whitehall, where he, in a speech, told them plainly, that though they had committed his servant without acquainting him, yet he

intended to deal more freely with them, and acquaint them with his intention to release his Secretary, which accordingly he did that very day."

Immediately after the prorogation of Parliament in 1678, Sir Joseph resigned his Secretaryship, and was succeeded by the Earl of Sunderland, from whom he received the sum of £6000, the price he had paid Lord Arlington on taking office, and the further sum of 500 guineas—a tolerable bonus for his bargain, to say nothing of the emoluments he had enjoyed during the retention of his office, with all its perquisites and personal interests to boot. These were the "good old times," when people understood why gentlemen were so anxious to go to Parliament, guided by most disinterested and patriotic motives to serve the "free and enlightened electors," and to promote the national interests!

If Sir Joseph parted with one honour—the Secretaryship of State—in a left-handed or derogatory way, according to our present ideas, he was not long in acceding to another honour—obtained, it is to be hoped, in a right-hand fashion—that was almost as prominent, and perhaps more dignified. On November 30, 1677, he was elected President of the Royal Society, London, and this office he held for three years. How this distinction came to be conferred upon him is, like many other circumstances in his private life and social surroundings, but imperfectly known. Had he been a liberal patron of the Society in which his royal master Charles II. took such lively interest? or was it in gratitude for favours to come through the same channel that the Society was induced to elect a Court favourite and State councillor

to its highest office? In explanation of his position, it should be borne in mind that the Royal Society then, and for upwards of a century later, consisted of two classes of persons—the working scientific, and the more courtly or ornamental. Perhaps Sir Joseph's affinities were more in accordance with the last-named class; at the same time, it must not be overlooked that he possessed scholarly attainments, and had fair opportunities of being conversant with foreign literature. Considering his energetic habits, and powers of dealing with men in other walks of life, it is not improbable that he took a laudable part in the business of his new office, if he did not enrich the Society with manuscripts and documents of historical interest such as he bestowed upon Queen's College, Oxford. Of his entire fitness for the presidential chair no one can be in doubt who has looked into the earlier records of the "Philosophical Transactions," containing as they do a farrago of physiological speculation and credulity, and a vast amount of puerilities on all subjects. The "Novum Organum" of Lord Francis Bacon, that had given fresh light to the world of science, and been everywhere recognised as the grandest advance ever made to a true philosophy, had not, apparently, even at the close of the reign of the Stuarts, produced its due impress on the English mind, or that section of it which sought for publicity to their scientific expression through the medium of the Royal Society.

Sir Joseph's political position can have been of no common kind when he was called upon to act as the English Plenipotentiary at the Treaty of Nimeguen in 1679. He was also honoured with the same office

at the pacification concluded at Ryswick in 1696; so that whilst he long enjoyed the confidence of the Stuarts, his capacity for work received the full approbation of the House of Orange.

Of Sir Joseph's parliamentary experience and utterances I have not been able to learn anything. Mr R. S. Ferguson states that Sir Joseph was ambitious of entering Parliament, and contested Morpeth, Preston, and Dartmouth, "but was at each place defeated"—thus implying that he did not obtain a seat in the House of Commons. This, however, is a mistake, as he represented the burghs of Thetford and Rochester between the years 1678 and 1700; in other words, sat in Parliament for several years. The following account of the representatives in Parliament for the burgh of Thetford is taken from Martin's "History of Thetford:"—

REPRESENTATIVES IN PARLIAMENT FOR THE BURGH OF THETFORD.

Charles. II., 1678.—Sir Joseph Williamson, Knt.; William Harbord, Esq.

" " 1679.—Sir Joseph Williamson, Knt.; William Harbord, Esq.

James II., 1685.—Henry Heveningham, Esq.*; Wm. de Grey, Esq.

Wm. & Mary, 1690.—Hon. William Harbord, Esq.; Sir Francis Guybon, Knt.; Sir Joseph Williamson, Knt.; Adam Felton, Esq. [Double return, the last being taken off.]

* Sir Joseph Williamson, the recorder, was elected burgess with Wm. de Grey, Esq.; but Heveningham, the mayor, would not return Sir Joseph, but returned himself. There was a petition and dispute whether the Freemen or Flowr (as they call them), or the select body of the Corporation, had the right to elect burgesses; and it appeared that the select body elected before the charter.

William III., 1695.—Sir John Woodhouse, Bart.; Sir Joseph Williamson, Knt.*
" " 1698.—Sir Joseph Williamson, Knt.†; Jas. Sloane, Esq.
" " 1700.—Sir John Woodhouse, Bart.; Sir Joseph Williamson, Knt.‡

Sir Joseph Williamson was an acknowledged patron of learning and literature, and a right good friend to his college. His interest in Cumberland and Westmoreland was shown in his correspondence with many of the leading people in both counties, from whom he derived both official and private news, and by his readiness to advance the personal aims of the more worthy of his countymen. Thus, on his recommendation, Dr Lancaster, who became Provost of Queen's College, Oxford, was early in life sent abroad by the order, and at the expense of, King Charles II. The same favour was bestowed on Nicholson, who was sent to Leipsic for the furtherance of his studies, and afterwards became Bishop of Carlisle. Sir Joseph was evidently a person of far-seeing character, and his experiences as plenipotentiary or diplomatist abroad told him how needful it was for the political representatives of England to be more duly qualified for their work than they could possibly be from the mere smattering of French and German to be got in our insular institutions. Hence his advice to King Charles II. to send young men of good parts who offered promise of distinction to the Courts of France, Germany, and Spain, to make them familiar with the historical

* In his place, chosen at Rochester, Jas. Sloane, Esq.
† In his place, chosen at Rochester, Chas. Lord Paston.
‡ In his place, chosen at Rochester, Thomas Hanmer, Esq.

circumstances of each nation, such information being well calculated to enhance the value of their labours in the different official appointments to which they might be credited.

In December 1679, Sir Joseph Williamson married the Baroness Clifton, widow of Henry Lord O'Brien, sister and sole heiress to Charles Stuart, Duke of Richmond, by whom he acquired large estates in Kent, and the hereditary office of High Steward of Gravesend.

Sir Joseph Williamson died in the year 1701, and his widow in the year following. Of their wedded lives I have no information to offer. Considering the high position he occupied in the State Councils during an exciting period of English history, the favouritism bestowed upon him by the "Merry Monarch," the Presidency of the Royal Society when science and letters were coming into notice, his wealth, and his generous distribution of it in a manner that could hardly fail to obtain publicity, it is not a little remarkable that his social relations, no less than his political appearances, should have found no more marked place in the pages of contemporaneous history than the doings of many of much inferior rank. His correspondence was extensive, and is said to have been preserved along with his State papers. If this be so, our national archives may some day furnish materials upon which to form a larger estimate of his inner life and character than has been attempted, or could consistently, with the general purport of this series be acted upon, in this humble tribute to his memory. The estates and official position that he gained in Kent by his marriage with the Baroness Clifton probably

induced him, after spending so many years in the political world, to seek more or less repose on the lower banks of the Thames. Some tie of unusual interest seems to have bound him to Rochester beyond his representation of its interests in Parliament in his latter years, as he bequeathed the sum of £5000 solely for the purpose of founding a mathematical school there. After playing so prominent a part in the policy and intrigues of the Court of the Stuarts, and in carrying out various schemes arising out of our national diplomacy, he, having attained his fifty-fourth year, might well desire to rest from the turmoils and responsibilities of office, particularly when his *otium cum dignitate* could be realised so worthily under the honourable ægis of the Royal Society.

Sir Joseph was evidently a man of good natural abilities, and cultivated his talents assiduously and to a purpose. Endowed with a prompt business habit, he carried out large and somewhat grasping aims with an energy that could not fail to obtain success. Be his enterprise what it might, nothing less than superiority and success contented his ambition. He was classical and scholarly, and fond of historical lore. He displayed a keen knowledge of the ways of the world, and of the character of the men and women within his sphere. His ingratiating manners and conversation were excellent passports to the highest society in England. He must have been a courtier of no mean order; indeed, the courtiership that gained so true and lasting a footing with the "Merry Monarch" and his mistresses could only arise from the manifestation of prepossessing

influences and a personal *suaviter in modo*, so greatly appreciated in the Court of the Stuarts.

During his lifetime he was a generous benefactor to his college (Queen's, Oxford). In the year 1666 he presented it with a silver trumpet and two pairs of banners. On this occasion Dr Barlow, the Provost, wrote to him that "the gift of the trumpet is most welcome, not only for its cost and curiosity, but for its congruity to them, who by statute are to be called to dinner with a trumpet; though better for him to give than a poor college to receive to call them to a mess of pottage and twopenny commons." He adds that it shall be used on all solemn days; but at other times their old brass trumpet shall serve their turn. The trumpet was a small matter compared with his building, in 1674, at his own, and a very considerable cost, the north side of the old quadrangle, which still remains a part of the present college. The fact is that he was a munificent contributor to his college, and left a legacy of £6000 in addition to what he had given so liberally in his lifetime. He also enriched the library with a long series of heraldic manuscripts and historical documents. The greater part of his heraldic collection was gathered by Sir Thomas Shirley, but some of the volumes were obtained from other sources by Sir Joseph himself. Queen's College also possesses two catalogues of Sir Joseph's own library, and some of his "Collections upon antiquarian matters of English history," and his notes upon diplomatic matters and English history in the eventful seventeenth century. Appended to MS. 134 in Queen's College is the following memorandum:—"This MS. was given me by

my worthy friend Dr Barlow, Provost of Queen's College in Oxon., 1671. Joseph Williamson." The MS. 68, "An account of a journey in Holland, made A.D. 1678, by William Nicolson, taberdar of Queen's, is dedicated by the writer to his patron, Sir Joseph Williamson."

The amount of Sir Joseph's benefactions during his lifetime, and by bequest, to Queen's, is not easily estimated; but with books, buildings, silver-plate, and money gifts, it could hardly be less than £10,000. Subsequent to his death, it is said that a Latin poem of 500 lines, celebrating his munificence, was composed by a fellow of Queen's.

Sir Joseph made a handsome donation of books to St Bees College, Cumberland; and to Bridekirk Church, "gilt Bibles and prayer-books, and velvet covering and rich linen for the altar, with silver flagons and chalices for the administration of the Holy Communion"—the church in which he had been baptized by his father, the vicar of the place. Among other kind acts, he bequeathed the sum of £500 to the grandchildren of Dr Langbaine, his early friend at Queen's College, Oxford.

A portrait of Sir Joseph Williamson, of three-quarters length, hangs in one of the places of honour in the hall of Queen's College. The information I possess regarding it is derived from some notes of my kind friend Mr T. W. Jackson of Worcester College. The portrait, a work of merit, reveals a self-confident, rather astute man of middle age. The face is well-proportioned, the features clean cut and well shaped, and rather delicate than heavy. His eyes are keen, and slightly closed; his nose straight

and delicate, but not wanting in size; his lips a little compressed, and his general expression that of a resolute man ever on his guard. His face is not that of a strong, but an acute and well-balanced man, who is not over-scrupulous, and means to win. Like Shakespeare's "Cassius," he had a keen, nervous temperament, combined, however, with a rather dark complexion. He wears a wig, it is supposed, though it looks like a natural head of dark-brown hair, long and curly. His dress shows a kind of doublet, somewhat open in the front, and clasped on the breast with a brooch, lace collar and ruffles. Wrapped about him, perhaps a fancy drapery, is a silk mantle light yellowish-brown in colour. His right hand rests on a table, and holds a paper, possibly in allusion to the Peace of Ryswick.

WILLIAM WOODVILLE, M.D.

"*Medical science is not merely a part of natural history; it is not a mere field for curious investigation, an arena for the sharpening of men's wits by ingenious theories and elaborate discussions; it has a momentous responsibility, an important practical aim, that aim being under all circumstances to alleviate suffering, to lighten and support life.*"—PROFESSOR MARX.

THE Woodvilles of Waterend, Loweswater, about seven miles from Cockermouth, were an ancient yeoman family of good position in West Cumberland. Their name, which is spelt as Woodville, Woodvil, Woodell, Wodle, Woodall, or Woodhall (the Loweswater people pronounce the name "Wodle" to this day) exists in every old deed connected with Loweswater, and especially in the deeds relating to the long and various suits waged by the landowners* against the

* The Woodvilles or Woodalls belonged to the old "statesmen" class, who held their lands by border service, as appears by the recital attached to a decree of the Court of Chancery dated April 25, 1597, in which the plaintiffs "Peter Hudson, Peter Burnyeate, John Woodall, George Iredell, John Pearson, and sundry other poor tenants of the Manor of Loweswater, exhibited their Bill of Complaint against Anthony Patrickson, Esquire, declaring thereby that the plaintiffs aforesaid, their ancestors, and those whose estate they had, and claimed to have of and in certain messuages and tenements, with certain lands

Patricksons of Frizington, the former Lords of the Manor.

Three generations of Woodvilles, grandfather, father, and son, bore the name of William in the last century. The first to be noticed here was William, the grandfather of Dr Woodville, who rebuilt the old family dwelling at Waterend in 1741, and placed a stone shield bearing his coat-of-arms over the door. This renovated mansion appeared so smart for the district, that the neighbours called it "Woodle's fine Place," or "Hoose," and the name of "The Place" holds good to this day. This William Woodville, falling in love with Sarah Bell, a Quakeress at Greysouthen, left the Established Church, and, like a true lover, became a Quaker for Sarah's sake. Their son William, the father of Dr Woodville, also followed Quaker principles, and married Jane Fearon, of Shatton, near Lorton, by whom he had six children. This William Woodville sold "The Place" in 1758, previous to which date he and

and commons thereunto belonging, and then occupied with the appurtenances in Loweswater and Thackthwaite, in the several occupations of the said plaintiffs and the other tenants there, or their assigns, *had time out of mind* been seized to them and their heirs, by, and according to, the ancient and laudable custom of tenant-right there used, being within the West Marches of England, over against Scotland, and about fifty years since, did hold the same of the late King Henry the Eighth by the said custom, and by paying a certain yearly rent, and by paying fines certain, at the death of the lord and death of the tenant for every their several tenements, further holding their several tenements by serving upon the said borders of England over against Scotland at their own proper costs and charges, within the said West Marches, then, and so often as thereunto they should be required by the Lord Warden of the said West Marches for the time being or his sufficient deputy or deputies, as well as defending the frontiers of the said Marches, as in offending the opposite Marches as occasion served," &c.

his family had taken up their residence at Cockermouth.

In the registers of the Society of Friends William and Jane Woodville are represented as the parents of Isaac Woodville, born at Waterend in 1749, and of a daughter, born in 1756, at Cockermouth; but there is no registry of their son William, the subject of this memoir, who is believed to have been born at Cockermouth in 1752.

Master William Woodville was sent to the free grammar school of his native place, and there received an education sufficiently classical and general to fit him for an apprenticeship to a Cockermouth surgeon and apothecary. He afterwards studied medicine at Edinburgh, where, after passing through the usual curriculum, he graduated in 1775. The thesis he defended for his doctor's degree was entitled "De Irritabilitate Fibrarum Matricium," and is said to have displayed considerable ability. Afterwards he visited some of the great medical schools of France and Holland, a circumstance that would imply a desire to cultivate the higher branches of his profession; at the same time it proved his possession of pecuniary means to gratify his love of travel on the Continent.

On returning home, he commenced medical practice in Cockermouth, and, as a man of parts, succeeded in obtaining the good opinion of the lieges. He was looked upon as studious in habit, skilled in physic, and not prone to join in the frivolities of the ordinary world. Now the days in which he lived were noted for a generous hospitality, and excessive drinking on the part of well-to-do people, particularly in the rural districts of Northern England. The song,

"Willie brew'd a peck o' maut" was truly applicable to the yeomen of every hamlet; for if Willie brewed in January, he was followed by Johnny and Tommy in February and March. In thus evading the gauge of the exciseman, conviviality was enjoyed with greater zest. People dined early, and drank deeply; they washed down their roast-beef and stiff suet-dumplings with strong beer, and then filled high the bowl, not with Samian wine, but potent rum or brandy punch. As toast and glee went round, the manly chorus resounded, "We'll not go home till morn;" and this sentiment was too frequently verified.

A story of Dr Woodville is worth relating, as exemplifying these customs, more especially as it illustrates a trait in his own character. He had been to a dinner-party; and as his temperate habits could not cope with those of the more seasoned disciples of Bacchus, he paid the penalty of intoxication. On his homeward-bound course he got off the road into some boggy ground, that greatly impeded his locomotion. "God help Woodal!" was his instinctive cry, often repeated, but to no purpose. His vision being dimmed, he fancied himself hastening to the utter darkness, and that an appeal to the prince of that region would be more appropriate, so he ejaculated, "Devil help Woodal! devil help Woodal!" Still no rescue from his topboot-deep immersion in the miry ground. After a pause, he seemed to regain his better senses, and said, "Help thyself, Woodal;" and so, screwing up his courage, extricated himself, to the great amusement of some rustic bystanders.

"Help thyself" was very much the motto of Dr Woodville when he found a field more congenial to

his tastes than country practice, which, in too many instances, is little better than physical and moral slavery. Yet he would probably have continued at Cockermouth all his life, and been unheard of beyond the immediate neighbourhood, had not a painful circumstance, affecting his personal history, changed all this very abruptly. His residence was at Papcastle, and had a small garden in front. One night he was roused by loud noises, which disturbed both him and his domestics; and on opening his window, saw a big fellow in the front of his house whom no entreaty would move, and from whom not a word could be elicited as to his purpose in being there; so the Doctor told him that if he did not leave the premises, he would shoot him as a burglar. The stupid rustic treated the repeated threats with contempt; so the Doctor took his aim, and unfortunately shot the man dead. Though the Doctor's explanation was corroborated by his domestics, public opinion ran pretty strongly against him, and he wisely decided on trying his fortunes in London.

Dr Woodville was not long settled in the metropolis when he received the appointment of Physician to the Middlesex Dispensary, the duties of which office he discharged satisfactorily. In the year 1792, on the death of Dr Archer, he obtained the higher honour of Physician to the Small-Pox Hospital, a situation he held through life, and ever with increasing credit to himself and the general interests of the institution.

Whilst a man of practical aims in his profession, he was not unmindful of those theoretical and collateral studies bearing upon the better comprehension

of therapeutics, or the remedies applicable to the treatment of disease. Wisely for himself, and not less happily for the advancement of his profession, he gave large attention to the study of botany, and more especially of that division of the subject which embraces plants of a medicinal nature. The path had been little trod, and he pursued it so faithfully, that in 1790 he issued a large and highly-valuable work in monthly parts, entitled "Medical Botany." This work, the publication of which marked a new era in the science, consisted of a series of plates representing medical plants, and containing an account of their natural history and uses. The pecuniary outlay on such a work must have been considerable, and the profits, it is to be feared, rather scanty, if at all visible beyond the bookseller's ledgers; so that Dr Woodville deserved no small meed of praise for his laborious exertions on behalf of the profession and the interests of the general public. The title-page of his work was as follows:—

"Medical Botany: containing systematic and general descriptions, with Plates of all the Medicinal Plants, indigenous and exotic, comprehended in the Catalogues of the *Materia Medica*, as published by the Royal Colleges of Physicians of London and Edinburgh: together with most of the principal Medicinal Plants not included in those Pharmacopœias, accompanied with a circumstantial detail of their medicinal effects, and of the diseases in which they have been most successfully employed. By William Woodville, M.D., Fellow of the Linnean Society, of the Royal College of Physicians, London, and Physician to the Small-Pox and Inoculation Hospitals."

The title-page is comprehensive, and fully borne out in the work itself, which is of real value, and, at the time of its publication, remarkably complete. Though the Linnean system of classification had been almost universally adopted, and this of itself had given an impetus to natural science, the works of Blackwell and Sheldrake were, up to Woodville's time, the only books in this country in which copper-plate figures of the medicinal plants were given. On the Continent, however, Regnault and others had issued works of a superior class on botany. Dr Woodville's volumes contained a great deal of original matter. Previous to the appearance of his work, the knowledge that prevailed of the "herbaceous simples" was little more than a servile copying of the past, and that past almost dependent on the authority of Dioscorides.

As no verbal description will suffice the student anxious for a thorough knowledge of vegetable forms, Dr Woodville acted well in offering coloured drawings of each plant whose natural history and medicinal uses came under his review. He engaged Mr Sowerby to execute and colour the plates—a Cumberland worthy, by the way, and an artist of established reputation in London, whose talents, according to Dr Woodville, "were not less conspicuous in the correctness than in the beauty of his designs."

The history of each plant is introduced by its *Synonyma*, copied from numerous and learned authorities, home and foreign. He displays a great amount of research, and a thorough acquaintance with the literature of the subject that could only be attained by an amount of labour but little under-

stood except by those who have passed through the same experience. To consult historical archives, and to eliminate the corn from the chaff, at the same time to give honour to whom honour is due, is the most unattractive part in the compilation of books, be they of a scientific, literary, or historic kind. This drudgery in the paths of literature, giving rise to the idea of men of literary tastes being "book-worms," was faithfully gone through by Dr Woodville in his "Medical Botany."

His *Synonyma* at the heading or introduction of each plant constitute a brief bibliographical notice. Then he gives the Linnæan class and order of the plant, the essential and general characters, the specific characters, the habitat of the plant, and a full description of it to the minutest details. I mention these circumstances to show, not only the arrangement of his work, but the pains bestowed upon it by the author to make it worthy of regard and of historical correctness.

The first edition, with 274 coloured plates, was published in monthly numbers from the years 1790 to 1794. The second edition, revised, was issued in 1810 in four quarto volumes. The third edition, in which 39 new plants had been introduced, with the descriptions arranged and corrected according to the natural system of Jussieu, was edited by Sir W. J. Hooker, the new medico-botanical portion being supplied by G. Spratt, London, 1832, small quarto, 5 vols., 310 plates. The fifth, or supplementary volume, by Sir W. J. Hooker and G. Spratt, was published separately to complete former editions, 1832, 35 coloured plates.

This enumeration of the editions will enable the reader to judge of the value attached to the original work on "Medical Botany" by Dr Woodville; and the name of Sir W. J. Hooker as editor is a further guarantee of the kind reception that it met with in Britain.

A few introductory remarks on a subject that engaged Dr Woodville's anxious attention for some years may not be uninteresting, were it only to show the great advantages possessed by the people of the present century, compared with those who lived in the olden time.

The first historical notice of small-pox dates from the siege and conquest of Alexandria, about the year 640, it being supposed that the armies of the Saracens conveyed the disease thither from Arabia. It may have existed before the time of Mahomet; but be its origin what it may, the disease was one of great virulence, that everywhere spread devastation and death among mankind. Perhaps no greater plague ever existed on the face of the earth; and why poor humanity should have been so afflicted is difficult to comprehend, when our highest thoughts revert to what theologians are pleased to call the merciful dispensation of Providence. It is difficult to persuade one's self that Providence could have a part in disfiguring the face of the human form divine, or in making a holocaust of vast multitudes of innocent children. If war sacrificed its thousands, small-pox destroyed its tens of thousands; and those who survived this awful scourge seldom escaped without some constitutional weakness or morbidity —the sequels of the disease. It spared neither age

nor sex, and left its marks upon all, especially the young, whose plump facial outlines and peach-blossomed cheeks lost all their beauty, and became indented with scars and disfigurement of features pitiful to behold.

This state of things went on for a thousand years at least, medical men being apparently as blind as fatalists to any amelioration being obtained by human art. At length a light was seen in the East in the shape of a discovery that offered part relief, and gave promise of something more. The new method of mitigating the severity of small-pox consisted in the introduction of matter taken from the fully-developed pustules of small-pox into the veins of a healthy subject,—it properly bore the name of inoculation,—and time showed that the persons who took small-pox in this "the natural way" generally had a mild attack compared with those to whom infection carried the disease. Early in the eighteenth century inoculation was known to a few English and French medical men sojourning in Constantinople and Greece; but the subject only came home to the British public through the following letter, written from Adrianople by Lady Mary Wortley Montague:—

"The small-pox, so fatal and so general amongst us, is here entirely harmless, by the invention of *ingrafting*, which is the term they give it. There is a set of old women who make it their business to perform the operation every autumn, in the month of September. When the great heat is abated, people send to one another to know if any of their family has a mind to have the small-pox; they make parties for this purpose, and when they are met (commonly fifteen or sixteen together), the old woman comes with a nut-shell full of the matter of the best sort of small-pox, and asks what vein you please to have

opened. She immediately rips open what you offer to her with a large needle (which gives you no more pain than a common scratch), and puts into the vein as much matter as can lie upon the head of her needle, and after that binds up the little wound with a hollow bit of shell, and in this manner opens four or five veins. The Grecians have commonly the superstition of opening one in the middle of the forehead, one in each arm, and one in the breast, to make the sign of the cross; but this has a very ill effect, all those wounds leaving little scars, and is not done by those who are not superstitious, who choose to have them in the leg, or that part of the arm that is concealed. The children, or young patients, play together all the rest of the day, and are in perfect health to the eighth. Then the fever begins to seize them, and they keep their beds two days, very seldom three. They have rarely above twenty or thirty [pocks] in their faces, which never mark, and in eight days' time they are as well as before their illness. Every year thousands undergo this operation; and the French ambassador says, pleasantly, that they take the small-pox here by way of diversion, as they take the waters in other countries. There is no example of any one that has died in it; and you may believe I am well satisfied of the safety of this experiment, since I intend to try it on my dear little son. I am patriot enough to take pains to bring this useful invention into fashion in England; and I should not fail to write to some of our doctors very particularly about it, if I knew any of them that I thought had virtue enough in them to destroy such a considerable branch of their revenue for the good of mankind. Perhaps if I live to return, I may, however, have courage to war with them."

Lady Mary Wortley Montague proved her faith by having her only son, then six years of age, inoculated. This was done at Pera, Constantinople, in the month of March 1717, and may be said to have been the first case where inoculation was practised on a British subject. Thus it was owing to the enlightened mind of Lady Mary that Great Britain had the honour of making the art of inoculation known to

civilized Europe, and by methods much more simple and effective than existed among the Thessalian women who boasted of an inspiration vouchsafed them by the Holy Virgin.

Dr Woodville's position in the Small-Pox Hospital affording him large opportunity of observation, led him to look carefully into the history of the disease, and, after collecting sufficient data, to write a treatise on inoculation. The title of his work (an octavo volume) was, "The History of the Inoculation of the Small-Pox in Great Britain; comprehending a review of all the publications on the subject, with an experimental inquiry into the relative advantages of every measure which had been deemed necessary in the process of Inoculation." The first volume of his history appeared in 1796; the second had only been got into rough shape when the grand discovery of vaccination by Dr William Jenner was announced to the world; and this, in the author's opinion, quite superseded the necessity of publishing his experimental investigations on small-pox.

The happy discovery of Jenner's, truly the most valuable ever recorded in the history of pathological medicine, naturally threw the system of inoculation, that Lady Mary Wortley Montague had been the means of making known to her countrymen, into the shade. And justly so, inasmuch as vaccination fortified the constitution against the infection of small-pox, whereas inoculation tended to spread the disease; that was more or less baneful, even in its modified forms. Vaccination naturally met with more or less opposition at first; for as everybody knows the precedents and usages of Englishmen—*laudatores*

temporis acti are weighty arguments affecting their opinion respecting the worth of every new doctrine introduced to public notice. Now Dr Jenner was only a provincial doctor, and this circumstance created a little jealousy in Cockneydom; moreover, his advancing the dicta of dairymaids as proof of the validity of his discovery could hardly fail to excite a certain amount of incredulity in the medical mind of England. Among those who expressed a doubt as to the scheme of vaccination being any advance on what was called "the natural way" of inoculation stood Dr Woodville, professionally wedded to the work in which he was engaged, and reluctant to believe that matter found in the pustules of the cow's udder, being introduced into the human system, could realise the prevention of that horrid scourge, small-pox. Time, however, is a great prover of the worth of new ideas; and observations well and faithfully directed, can alone settle medical problems. And by observation, Dr Woodville, like other professional men, became convinced of Jenner's noble discovery; and as a true disciple of Esculapius, did his best to promote the introduction of vaccination to the metropolis.

From an article on Woodville in Rees Cyclopædia, it appears that Dr Jenner had some difficulty in persuading Dr Woodville of the truth of vaccination, and that much argument and remonstrance arose between the contending parties. The writer goes on to say:—"The discussion, however, as is always the case, proved very useful in the dissemination of the new practice; and if Dr Jenner had reason to find fault with the result of Dr Woodville's early proceed-

ings, he must have been abundantly gratified by his frequent experiments and publications. The ample field in which Woodville was placed enabled him to vaccinate great multitudes, some thousands of whom he afterwards tested by variolous inoculation, and thus gave that publicity to vaccination, and that confidence in it, which it could not otherwise have attained in the course of many years. He was also ardently engaged in the inquiry into the nature and origin of the vaccine lymph; and at his request, the writer of this short article three times inoculated him with fresh grease from the heel of a diseased horse."

On Dr Jenner's discovery being thoroughly tested in England, it got sounded throughout Europe as the greatest blessing of the age; and it deserves notice that the continental nations, especially the German and Scandinavian, have been more exacting in the performance and perfection of vaccination than Britain herself, where permissive rather than compulsory Acts too long prevailed. Everybody should know that vaccination is a true antidote to small-pox, beyond all manner of question; yet there are still to be found a few foolish and ungrateful Englishmen, deserving to be classified with the "peculiar people," who are blind to the blessings of vaccination, blind to their own family interests; and not only blind, but perverse in feeling towards the rest of the community. Discoveries in medicine, like political and social reforms, are apt to be viewed as innovations; and for a time there was a deadset made against vaccination by prejudiced women and pseudo-philanthropists. The same class of persons, including a few divines and members of Parliament, and too

many of the irrepressible emotional sex, have of late mounted the public platform to discuss another contagious disease in a way calculated to upset one's notions of delicacy being one of the golden attributes of British maidens and British matrons.

A portrait of Dr Woodville, painted by Abbott and engraved by Bond, shows the author of the "Medical Botany" in a most favourable light—sitting in his arm-chair, and apparently at ease with himself, both mentally and bodily. He presents a fine open countenance, bright eyes, and regular handsome features; altogether a man whom the female novelist would delight to call nice, prepossessing, if not charming. His hair being combed back, reveals an ample forehead, whilst his flowing locks adorn the temples, and give breadth and character to his physiognomy. His frank, expressive face has much of the rotundity of youth; whilst his lips, as depicted in the portrait, offer a type that would have been worthy of the poetic times when burning Sappho loved and sung.

Dr Woodville is styled M.D. and F.R.S. beneath his portrait. This is an error. He was a Fellow of the Linnæan Society, elected January 18, 1791, but not of the Royal Society. In proof of the esteem in which he was held, it may be observed that his engraved portrait heads the page of a large sheet, gracefully adorned by a medicinal plant; whilst below is a "View of the Inoculating Hospital of St Pancras," designed by Shepherd and engraved by Woolnoth. The publication of this appropriate tribute of respect to the memory of a worthy physician was due to Dr Thornton, who issued it in August, 1806, the year following Dr Woodville's death.

The following anecdote of the doctor would imply great self-possession and foresight, and no small amount of consideration for the duties likely to devolve upon his executors:—"A few days before Dr Woodville's decease, his friend Coleman, professor at the Veterinary College, playing at chess with him, at the Small-Pox Hospital, the arrival of Mr Greatrex, an undertaker, was announced. On his entering, the doctor requested him to sit down, saying, the game was nearly finished. 'Mr Greatrex, there was a misunderstanding between you and me, and my settling with you, on leaving Ely Place, and I am desirous of showing you that I am at peace with you, as I hope to die in peace with all men. I am just on the point of departing, have but very few days to live, and wish to arrange with you the order of my funeral.' The astonished undertaker had never before been so addressed; hoped the doctor was quite mistaken—that he might yet live many years. 'Many of my friends, Mr Greatrex, address me in this way, and, were I young, I might wish a restoration to health; but the system is done—a return to health and vigour is impossible. Having been brought up a Quaker, I wish to be buried amongst them, and in their plain way, to avoid every unnecessary expense. You will therefore now consider the amount of the necessary disbursements for the occasion, and I will discharge them. It will save some trouble to my executors.'"

Whatever the disease may have been that removed Dr Woodville from a sphere of practical usefulness, he seems to have had a perfect knowledge of its character, and the approach of its crisis. No one can

have met "the great enemy" with less perturbability of feeling; and it is to be hoped that this philosophic calmness proceeded from a belief that he had done his duty faithfully and well towards both God and man. As he died on or about the 26th March 1805, he can only have completed his fifty-third year. Previous to his funeral, Mr Highmore, one of his colleagues, "delivered an address to his memory," in "the saloon" of the Small-Pox Hospital.

After paying a well-deserved tribute to his literary labours and medical histories, Mr Highmore spoke of his professional reputation, and his zeal in the promotion of Dr Jenner's discovery of vaccine inoculation:—"After the minutest experiment, and the most unequivocal testimonies of its success, it was to our departed friend that this institution claims the honour of its introduction into general practice in the metropolis, and, as one of the branches of the establishment, to have been instrumental, superadded to the subjects of its former fame, in conveying comfort and security to more than 17,000 persons during the last six years; a number which, in addition to those which have received the same benefit from other societies, and from the liberal exertions of other medical men, will live to teach their children, and their children's children, to bless the name of Woodville when they bless the name of Jenner."

Dr Woodville was interred, by his own desire, in the "Friends'" burial-ground in Bunhill Fields, London, after an appropriate address at the grave-side by Mrs Pryor.

JOHN WALKER, M.D.

"Each man in his time plays many parts."—SHAKESPEARE.

JOHN WALKER was born at Cockermouth on July 31, 1759. His father was an ironmonger and smith by trade, and this seems all that is known of him. Educated at the Free Grammar School of Cockermouth, young Walker showed a fair amount of ability, chiefly in the direction of classics. He never liked steady work, but preferred play and boyish mischief of all sorts; occasionally trying to hoodwink his drowsy schoolmaster, whilst out of doors he was ripe for every juvenile prank. The erratic disposition of the lad seems to have been early manifested, and had much to do with the figure he cut in the world.

Though apparently born to better things, young Walker adopted his father's trade, and put on the leathern apron of the smith for five years, not without showing a lingering feeling for his classics by inscribing over the entrance of his father's forge part of Virgil's description of the Cyclops. His arms being scarcely equal to the heavier work of the hammer and anvil, he took to the engraving of the

ornamental parts of polished grates and fenders. This homely service did not content him whose love of venture was an inherent part of his nature, and his next vagary prompted him to go to sea. In his wish to join a privateer, he sailed to Dublin in June 1779; but instead of pursuing his marine penchant, entered into the fun and frolic of the Irish capital, and spent the whole of his cash. An empty pocket revived his early love of art, and induced him to enter into an engagement with an engraver well qualified to teach him. According to Dr Epps' biography,* which is very much my guide in this memoir, some of Walker's work is to be found in *Walker's Hibernian Magazine* for the years 1780–83.

He now bid fair to earn a livelihood, and a little reputation with his burin, when, apparently without much consideration, he abandoned it for the ferule of the schoolmaster. The word ferule may be looked upon as metaphorical, if it be true that he did not resort to coercion or corporal punishment, but ruled his scholars by tact and kindness. His friends tried hard to persuade him to hold on by the certainty of engraving rather than incur the doubts and the irksomeness of teaching; to their good counsel he replied, "*Possunt quia credunt posse,*" or "They must conquer who will." The Anglo-Hibernian dominie had no pleasant time of it in his new avocation, inasmuch as it proved highly exacting and little remunerative, so that the Latin quotation he threw at his friends rather than follow their advice, proved a two-edged sword most incisive to

* The Life of John Walker, M.D., by John Epps, M.D., 8vo. London, Whittaker & Co., 1831.

the wielder of the weapon himself. The next turn of the wheel was a duality of effort combining the two arts of engraving and teaching; the one practised by day, the other by night. The erratic mind is generally credited with genius, so that with all his fitfulness of temperament, Walker had been able to impress those around him with the notion that he was a man of many talents, and therefore worthy of encouragement.

In the belief that he could present more general views of natural philosophy and history for the instruction of youth than any with which he was acquainted, he planned a Geography and Gazetteer. This work was published in 1788 by subscription, and at so low a price that he was obliged to engrave the principal plates himself. Plodding on with his schoolmastering, and gaining friends by his successful training of youth, he was induced to publish, on a larger scale, a second edition of his Geography and Gazetteer, also by subscription. To ensure a sufficient number of subscribers, it was needful for him to travel through England and Wales and Ireland as a book-agent, recommending and selling his own publication.

Before accompanying him on his commercial tour, which eventually separated him from all his Dublin associations, the reader should be apprised of circumstances affecting his religious status no less than his future career. His father belonged to the Baptist community, his mother was an Independent, so that under the parental wing, there were two avenues open to his soul's welfare. Being unable to reconcile his religious thoughts with either form of home

Puritanism, he turned his eyes elsewhere; and gradually came to look upon the doctrines of the Society of Friends as more congenial to his views than any other denomination of Christians. Accordingly he approached that peaceful sect in Dublin, in the hope of being admitted to their ranks, and the better to insure the success of his application, he mounted the regimental drab and broadbrim,* nay, adopted the ultra-phraseology of Quakers. His braving the gibes and jeers of the vulgar world in this demonstrative way argued well for the sincerity of his convictions. The Society, however, did not respond to his external emblems, but, looking rather to the inward grace of the man, deemed him unstable in disposition, and religiously "unsound." He was at that time an engraver, and found or believed he found that Quakers were hostile to the delineation of the human figure in the nude,† or any other form. As such delineations enter more or less into the composition of *genre* pictures, and form part of all mytho-

* A story is told of Walker's appearing bare-headed on the Dublin quay when his finances were exceedingly low, and seeing a Whitehaven schooner leaving her moorings, sought a passage homeward bound. A friend in Whitehaven helped him to as broad a brim as any disciple of George Fox could wish for; and with this head-gear, and bodily habiliments rather threadbare, he made his way to Cockermouth and the paternal roof.

† Some of the strictures made upon Quakers by the witty Rev. Sydney Smith were justifiable; as on matters of art, "Friends" were certainly peculiar in the olden time. The dull feeling they used to show for æsthetic considerations, both domestic and social, has been much modified of late years. The dress of "Women Friends" is made very carefully to exclude all appearance of the nude, whatever may be the worldly fashion; but this does not necessarily imply on their part an objectionable attitude towards Greek art in its noble delineation of the human form divine.

logical studies, he deemed it advisable to abandon his calling for the purpose of securing a proper footing in the Society. More solid objections, however, than his art pursuits weighed with "Friends." What in the Irish capital would be termed "big larning" to which Walker made some pretensions, did not accord with the simplicity* of their faith, nor could his eccentricities be viewed unconcernedly by the most steady-going sect of the British Isles. And a weightier objection to his admission rested on his unbelief in the divinity of Christ, and his non-acceptance of the inspiration of holy writ; and these great flaws in his profession of faith were quite enough to damn him in the eyes of the orthodox, be they broad-brim, shaved-crown, or lawn-sleeved *doctrinaires*.

The success attendant on his canvassing for subscriptions induced him to publish his Geography and Gazetteer in London. This book was one of the best of its kind, and was received with favour in the schools throughout Britain. And though Quakers would not enrol the author among their members, or

* Though men of renowned intellect have sprung from the Society of Friends, *e.g.*, John Dalton and Thomas Young, the possession of great learning is not looked upon as either a moral or religious passport by the ministers and elders of that body. Indeed, within the last quarter of a century I have met with dear Tabithas and worthy Obadiahs who were shocked on hearing the word logic sounding in their ears—the term logic having, according to their interpretation, "a bad," almost a satanic meaning. I was startled by this state of ignorance on the part of men and women who officiated as "ministers," and who, it might have been supposed, would have prized the logical thought wherever it found utterance. Further experience showed me that "the argumentative method," or "the subtle reasonings," were viewed by Quakers as slippery ground for the meek Christian who had only to listen, and believe, and make his peace with Heaven. Delightful faith!

tolerate his allegiance, they were among the first to acknowledge the superiority of his Atlas and Geography in their special schools. As the work was going through the press, Walker took a fancy for physiological pursuits, and entered himself as an anatomical student at Guy's Hospital, where he continued for probably two years, passing through the regular curriculum required of surgeons and physicians. With the view of enlarging his knowledge of the medical profession, he set off to Paris in 1797 —the doings of the Revolution apparently not affecting his determination.

On entering Paris, a new scene dawned upon Walker. The capital was alive with excitement and national fervour; and men's minds dwelt only on the political situation of France. In the piping times of peace, strangers in Paris, however grotesque in manner or dress, would pass unnoticed; but now every one, from the *gamin* on the Boulevards to the venerable sage in the "grand Councils," was on the *qui vive* for the news of the hour, or any novelty of situation that might offer. And who could have supposed that in the great turmoil of Paris in 1797 the newest excitement for her citizens and citizenesses would hail from the borough of Cockermouth? But so it was. *Our* John Walker, the observed of all observers, dressed in full Quaker canonicals, with a brim broad enough to shelter himself from sun and rain, was seen stalking along the streets, gazing with uplifted eyes on all he saw, and thereby eliciting the special attention of the gay students and gayer *grisettes* of the gayest capital in the world.

Walker visited the public institutions, and availed

himself of the opportunity of listening to the eloquent men of the Tribune; yet he not only displayed no signs, by tricolour emblems or cockade, of allegiance to the ruling powers, but, against all discretion and good manners, kept his big beaver on his head whilst every one else stood uncovered. This was naturally viewed as an insult to "*la grande nation;*" he was hauled to a court of justice, to answer for his unintelligible behaviour; and there he pleaded his Quakerism, his peaceful attitudes, and professional aims. His reasons, though sounding most strangely in the lively Celtic ear, were received with virtuous forbearance on the part of the Government, through whom the *gens-d'armes* were instructed not to molest the singularly attired and singularly mannered stranger. This escape from the clutches of the law did not save him from the louder attentions of "young Paris"—always fond of fun, and at that time exuberant in mischief, and specially glad of a new opportunity of venting their unsparing ridicule on a foreigner. Walker was the latest importation from "perfidious Albion," and what was more, he had created a new sensation among the *proletariat.* The news-boys in the Palais-Royal kept up the humour of the thing by offering papers for sale, and vociferating, among other remarkable events of the day—"*Voilà! Citoyens! Voilà le grand détail d'un homme assez singulier qui ne voulait pas oter son chapeau au tribun du conseil des anciens. Voilà le grand detail!*" Friend Walker listening to a description of his own singularity may have anticipated with painful feelings the observation made long afterwards at the political hustings of his native place, and now become pro-

verbial—"What will they say at Cockermouth?" Assuredly, Cockermouth would not have failed to appreciate the situation of citizen Walker caricatured with his broad beaver, standing among the powdered wigs of state counsellors.

Despite the laugh against him, Walker joined his compatriots Tom Paine, James Napper Tandy, and others of ultra-political views; whilst he held on by his "Yea and Nay," the peace professions, and drab habiliments of Quakers. Thus, when the British exiles dined together for political reasons, and Tandy proposed as a toast, "Gentlemen, may the tri-coloured flag float on the Tower of London," Walker did not join in it. On Paine seeing this, he remarked, "Walker is a Quaker with all its follies: I am a Quaker without them."

His garb and non-compliance with the prevailing order of things were sources of embarrassment to both himself and friends, as well in travelling as in Paris. Thus, one day, wishing to enter the gardens of the Tuileries with a lady on his arm, he was stopped by a sentinel. He offered explanations, but all in vain, till the lady, "with the lovely vivacity of her nation, looked behind at the soldier, pointed with her finger to her forehead, glancing sideways at Walker." The soldier understood the hint of his being rather crazed, and said, "*Pass!*"

The enterprising son of Cockermouth seems to have mingled freely in Parisian society, and to have become intimate with the "Theo-philanthropists," who were probably an allied genus of the German *Illuminati.* M. Hauy, one of the chiefs of the sect, asked Walker if the Quakers believed in the divinity

of Jesus Christ, to which he replied, "It is a doctrine recognised in the official proceedings of the Society as a body, but many members held the contrary doctrine." "*Ils ont raison, Jésus etoit un philosophe,** *pas un Dieu,*" was M. Hauy's rejoinder. Dr Epps says that Walker did not believe the Scriptures to be divine, nor did he approve of the formation of any church, believing that every man has "an internal monitor, which, if it be duly attended to, will be found to be to him the true church."

From Paris he went to Leyden, then enjoying high repute as a school of medicine; and there, in the year 1799, he obtained his doctor's degree. Previous to his leaving England he seems to have been betrothed to Annie Bowman, of Cockermouth, who, according to Dr Epps, supplied Dr Walker with money to enable him to pursue his medical studies abroad. This opinion does not find sanction by the banks of the Cocker to-day; for though the Bowmans were worthy folk, they would hardly be prepared to make so great a sacrifice for a daughter's intended husband. Walker delighted to call the object of his affections "My Annie," and on attaining his medical honours, felt, as all true lovers do, most anxious for the consummation of marriage. Again his Quaker prin-

* Various epithets have been applied to the Second Person in the Trinity, but nowhere do I remember him characterised as a philosopher. Voltaire and the great intellects of France looked upon Christ as an Eastern impostor. Some have viewed him as a mystic, others as a myth; but M. Hauy, enjoying philanthropic feelings, took higher ground than his compatriots. When the "Peace Congress," of English growth, and consisting mainly of Quakers, met at Paris in 1848, they were addressed by a Frenchman, who spoke of Christ as a *Proletariat.* The Christian believer views Jesus in a very different light.

ciples troubled his course, as he looked upon marriage as a civil contract, and wished dear Annie to meet him in Paris, where the ceremony could be got over without any questions being asked. This request not being compatible with her views, he came to England, and made Annie his wife at Glasgow, on October 23, 1799. The newly-married couple spent the winter of 1799–1800 in Edinburgh, and in good society. In the spring they moved southwards to Gloucestershire.

Application being made by the Neapolitan Government to the proper authorities in London for the services of persons qualified to practice the new system of "vaccine inoculation," Dr Marshall was appointed, who stipulated that Dr Walker should accompany him. On July 1, 1800, the two doctors embarked in the *Endymion* for Gibraltar, where, and at Minorca and Malta, they spent some weeks in promoting the object of their mission. Dr Walker then proceeded to Alexandria, and vaccinated all the seamen and soldiers of the expedition under Sir Ralph Abercromby—truly a great service; he also aided the sick and wounded, and incurred considerable expense, only one-fourth part of which was refunded to him by the British Government, and this notwithstanding the strong recommendation made by Major-General Hutchinson to his Royal Highness the Duke of York on Walker's behalf.

Whilst staying in Egypt, if not previously in the Mediterranean, Dr Walker allowed his beard to grow to its full proportions. In Cairo he also mounted a big white hat, and thus appeared a real oddity. The young officers of his mess used to play tricks upon

him, and one day drew in coloured chalk the French *fleur-de-lis* upon his broad beaver. The Doctor, in ignorance of all this, walked out, meditating as he went along the streets. Soon the French insignia, so hateful to the Turk, attracted attention; Turkish soldiers crowded around, by whom he was roughly handled, and carried off to prison as "a vile Frenchman." He was saved by an English patrol, who explained that the bearded philosopher was not a French intruder, but an English civilian. A second time, whilst in the direction of Ghizeh, his beard had nearly cost him his life at the hands of a Turkish cavalry soldier; nevertheless, the Doctor would not cut off his facial adornment, or show any regard for the natural prejudices of the people around him. After incurring other dangers, he had the good fortune to get a berth in the *El-Carmen*, commissioned to bring home despatches regarding the fall of Alexandria. On arriving in England, he joined his wife at Stonehouse, in Gloucestershire.

As early as January 1800, a "Vaccine Pock Institution" was established in London, which received the name of the "Jennerian Society," on December 16, 1802. A few months prior to this, Dr Walker had, on his own responsibility, commenced the work of vaccination, and met with much success. On January 3, 1803, the Royal Jennerian Society was launched, and Dr Walker received the appointment of "Resident Vaccinator and Medical Secretary." After a time he seems to have deviated from his instructions, and to have incurred the displeasure of Dr Jenner and the Medical Council, so he resigned his situation. Several of his friends, looking upon him as

an aggrieved person, got up the London Vaccine Institution, the practical direction of which was placed very much in Dr Walker's hands. Amidst the changes to which all young institutions are liable, he enjoyed the entire confidence of those who believed him to be a willing servitor of the great public interests. The whole energy of the man was displayed in the various vaccine stations of the metropolis; but adopting his biographer's picture of him in his daily walks does not show him in the truest amiability of temper that should guide doctors in their medical relations. He was evidently cross with the matrons, and heedless of the screams of the babies in their arms, the success of the operation of vaccination being his determined aim and sole consideration. The mothers were lectured, when they would gladly have escaped from his room, and might be heard saying, "What a cross old man!" On the other hand, they felt more grateful when he would address them, "Thy child is safe, fear not; fare thee well."

In addition to his being a graduate of the University of Leyden, he was a licentiate of the Royal College of Physicians of London, and Director of the Royal Jennerian and London Vaccine Institution.

Dr Epps describes his friend thus:—

"Dr Walker was about five feet seven inches and a half. His features were long and prominent, especially the nose and the chin. His eyes were large, also his eyebrows, his forehead high, his hair dark brown, which he combed back straight, like the patriarchs of old. His bones were large, and were prominently marked, from the spare habit of his body. He wore a white beaver broad-brimmed hat, large

broad-tail coat, the pockets full of papers; a portfolio under his arm."

He was moderate in eating, and vastly fond of tea. He believed in water rather than malt or spiritous liquors, and attributed the rapidity of the recovery of the Mussulmans under their wounds to their use of water, promoting a healthy condition—an opinion that my own experience would fully corroborate. He took both animal and vegetable food; and on the day he died he said, "Annie, bring me some *animal fibre*."

He laboured on the most humble pay for twenty-eight years in the cause of vaccination—a long and valuable service, almost entirely performed at the various vaccine stations in London. He was no less zealous in promoting vaccination in country districts, far from the metropolis; and when he could enlist a "Lady Bountiful" like Lady Fane in the cause, he was much gladdened. His soul was in his work, but his biographer uses too high-flown language in designating him either a martyr or an apostle of vaccination. Throughout the whole of Britain the Jennerian discovery was welcomed by all sensible medical men; and as early as October 1800, Dr Heysham, of Carlisle, vaccinated his youngest daughter, and continued the good work to all, without fee or reward, for many years. He differed not philanthropically from his Carlisle colleagues, nor from the rank and file of doctors in the country at large.

Dr Walker seems to have been of a nervous, wiry habit, upon whom little change, either mentally or corporeally, was exhibited till he reached his threescore and ten years, when disease of the lungs affected

him. He continued to do his duty to the last week of his life, and probably accelerated his death by making too great efforts to wind up his temporal affairs before parting hence to the unknown. Though so strong a believer in vaccination, he had little faith in the art of therapeutics, and refused to take medicines to relieve his cough and other symptoms. He died on June 23, 1830, leaving a widow, but no issue.

Though Dr Walker manifested much peculiarity of disposition, amounting to eccentricity, he was a many-sided man, whose aims were successfully directed to educational and philanthropic projects. He did more for the world's good than the world can be said to have done for him. He was miserably paid by the Government in Egypt; and his daily and hourly services in the cause of vaccination never realised for him an ordinary clerk's wages. He laboured to promote the interests of his fellow-men with hearty zeal, and without a single mercenary thought in his mind.

ROBLEY DUNGLISON, M.D.

"The object of a public teacher is no longer to inculcate a particular system of dogmas, but to prepare his pupils for exercising their own judgments, to exhibit to them an outline of the different sciences, and to suggest subjects for their future examination."

DUGALD STEWART.

ROBLEY DUNGLISON was born at Keswick* in Cumberland, on the 4th of January 1798. His father was William Dunglison, a woollen manufacturer, and his mother, Elizabeth Jackson, was the daughter of Richard Jackson, also engaged in the same trade. On the maternal side Mrs Dunglison was a Robley, and as the family were of good repute, young Dunglison was not inappropriately named Robley. Curiously enough, the Dunglisons, Jacksons, and Robleys, followed the same mode of earning a livelihood, so that the linsey-woolsey interests of Keswick were intimately associated with the ancestry and name of Robley Dunglison, and tended in no small degree

* His birth took place in a house at the higher part of the Main Street of Keswick; but soon afterwards his parents removed to a house in Museum Square, immediately opposite Museum House, the property of Mrs Dunglison, and here Robley Dunglison was brought up. The house fell to him on his mother's death, and he sold it.

to give him a good start in the world. The woollen stuffs, and the more famed "wad" or lead pencils of the central market-town of the Lake District, no longer claim the consideration they possessed at the beginning of the century; but if local history be faithful to its purpose, the parentage of Robley Dunglison, one of the ablest of modern medical writers, may serve to recall the once flourishing interests of his native place.

Robley's father died at the early age of thirty-five years, and his mother for a time carried on the business. Mrs Dunglison, who bore another son and a daughter to her husband,* was a remarkably clever and managing person, who had inherited the Robley character for energy and superiority of aim; and to her intellectual and moral training her son Robley owed not a little of his manly bearing and assiduity in the world. The success of his uncle, Joseph Robley, who had risen to opulence as a planter in the West Indies, and with whom he was a favourite, indicated the propriety of young Dunglison fitting himself for mercantile pursuits, with the view of emigrating to "the plantations." Whilst preparation was being made for this step, Mr Robley died, leaving to Mrs Dunglison the sum of £3000, by which she was enabled to give her family a liberal education. Now a new path had to be sought for the lad of promise; and whether from his own natural proclivities, or through the influence of his friends, Robley Dunglison

* Mrs Dunglison married again to Mr James Atkinson, who was the manager of the Cumberland Union Bank and Postmaster at Keswick, by whom she had one son, Dr John Richard Atkinson, now in America, and two daughters; one was married to the Rev. E. S. Berry, the youngest was married to Mr Alexander Macpherson.

made up his mind to study medicine. To render his education worthy of the professional life, he was placed under the care of Mr Saul of Green Row Academy, Abbey Holme (already mentioned in p. 182), where he made himself well acquainted with the Greek and Latin languages, and gave large attention to English composition. Several manuscript volumes of his scholastic exercises in composition are still in the possession of his family, which go to prove that the order and system characterising his juvenile efforts, and which formed such marked traits in his subsequent career, were truly innate qualities of his mind, the full development of which led to his attaining such brilliant success as an author and teacher.

As a schoolboy, Robley Dunglison was noted as a lively, amiable, and clever youth, of very studious habits. Though nurtured amidst the most lovely scenery of the Lake District, and not wanting the gifts of imagination, much less the art of English composition, he showed, as far as I can learn, but little poetic feeling beyond writing a song on Keswick Races, in which he painted in happy colouring the leading actors in the sporting field. It would have been incongruous with the education and temperament of Robley not to have his pulse stirred by the contemplation of the lakes, the mountains, and varied picturesque surroundings of his birthplace, to which thousands of tourists are annually drawn from all parts of the world. That he was not an inattentive observer of natural phenomena, and not uninformed on the traditional beliefs and historical opinions of the district, is evidenced by his writing, when he

was only nineteen years of age, a paper for the *London Monthly Magazine* for 1817, on a floating island in Derwentwater Lake. At a subsequent period he contributed "Legends of the English Lakes" to the *Virginia Literary Museum and Journal of Belles-Lettres, Arts, and Sciences.*

At seventeen years of age he was apprenticed to John Edmondson, sen., then a surgeon of repute at Keswick. On completing his time, he went to London, and acted as assistant to Mr Haden, the obstetrician. Whilst so engaged he carried on his medical studies in London, and for a time also in Edinburgh and Paris. On obtaining the necessary qualifications of surgeon and apothecary, he commenced practice in London in the year 1819. Being anxious for the higher honours of his profession, and not able to obtain the degree of M.D. in Edinburgh, owing to the then unwise regulations of the University, he went to Erlangen, and graduated there as Doctor of Medicine in 1824, making *Neuralgia* the subject of his thesis. His partiality for obstetrics got him the appointment of physician-accoucheur to the Eastern Dispensary; and in May 1824, he announced that he would deliver a course of lectures on his favourite subject. This laudable project was set aside in a very unexpected way by his receiving an invitation from Thomas Jefferson, ex-President of the United States of America, the founder of the University of Virginia, asking him to fill one of the chairs in its medical department. Most of the professors in the new institution were foreigners, selected at the request of the Board of Visitors by Mr F. W. Gilmer, who was sent to England for the express

purpose. No appointment proved so advantageous to the United States as that of Dr Dunglison; and, as Dr Gross* remarks, "it reflects no little credit upon the sagacity of the agent of the University that his choice fell upon a mere youth, hardly twenty-six years of age, who, however, had already given great promise of distinction by the publication of a monograph on the 'Stomach and Bowel Complaints of Children,' and by various contributions to the periodical press, as well as by the display of extraordinary energy and unbounded ambition."

Dr Gross states that "young as Dr Dunglison was when he left his home in the Old World, deep and heartfelt regret was expressed at his departure, not only by his professional friends and advisers, but by the London Medical and Hunterian Societies, of which he was at the time the foreign secretary, and which complimented him, by the passage of a series of resolutions full of sympathy and cordial good wishes."

Immediately previous to his departure for America the Doctor married Harriette, daughter of Dr John Leadam, of London. The newly-married couple sailed on the 27th October 1824, but owing to adverse winds and tides, were detained six weeks in the English Channel, and did not reach Charlottesville

* "Memoir of Robley Dunglison, M.D., LL.D., read before the College of Physicians of Philadelphia, at a special meeting held October 20, 1869," by S. D. Gross, M.D., LL.D. This excellent memoir of Dr Gross (a pamphlet of twenty-two pages), constitutes the basis of my brief biographical sketch of Dr Dunglison. And here I may take the opportunity of thanking my friend Mr I. F. Crosthwaite, Manager of the Cumberland Union Bank, Keswick, for his great readiness to oblige me with every information relative to his friend, the subject of this memoir.

till the middle of February 1825. During this protracted voyage, the Doctor was not idle in thought, but zealously engaged in preparing for his new field of duty, and that of a most onerous kind. He had covenanted prior to his departure from Europe to teach in the University of Virginia anatomy, physiology, surgery, materia medica, pharmacy, and the history of medicine—truly a Herculean task beyond the powers of any single man to accomplish.

He resided nine years at the University of Virginia, and there laid the foundation of a solid and enduring reputation as a medical author. His industry knew no bounds. The first-fruits of his labours were his "Human Physiology," in two portly octavo volumes, and his well-known "Medical Dictionary." These were unquestionably the most valuable medical works to be found on the Continent of America at the time of their publication, and might well be considered a wonderful achievement. The motto of his physiology, adopted from Haller, whose doctrines, by the way, he upheld against all comers, showed the purpose of the author, although the scope of the work reached far beyond its meaning, "*Vastissimi studii primas quasi lineas circumscripsi.*" He also published, conjointly with Mr George Long, an "Introduction to the Study of Grecian and Roman Geography."

"His house at Charlottesville," says his biographer, "was in every respect a most charming one, graced by all the elegancies that can adorn private life—a refined and highly-cultivated circle of friends, mostly members of the different professional staffs of the University; a refined and luxurious ease, even

in the midst of the most arduous labours, and the society of books and periodicals which always lay scattered in profusion upon his tables, and served, along with music and conversation, to beguile his leisure moments."

On accepting the chair of *materia medica,* therapeutics, hygiene, and medical jurisprudence in the University of Maryland, he transferred his residence to Baltimore in the autumn of 1833. Here he remained three years, during which time he composed his work on "General Therapeutics," &c., and brought out a new edition of his "Human Physiology," and also contributed various papers to the medical press.

In June 1836, he was appointed Professor of the Institutes of Medicine in the Jefferson Medical College of Philadelphia, a chair, expressly created for him, and which he held until the spring of 1868 when ill-health compelled him to resign. He did much to enhance the reputation of the college, and thereby to promote the progress of medical science in the United States.

Dr Dunglison was one of the most voluminous writers of his day. Allusion has been made to an article on the "Floating Island of Derwentwater," published by him in the *London Monthly Magazine* as early as the year 1817; this was followed by a paper in the same journal on "The Wind of a Ball," one on "Anthropophagi," and one on "Collectanea Dietetica," under the signature of "Philos." In 1822 he published in the *Annals of Philosophy* an article "On the Phenomena of Vision," produced by dilating the pupil by belladonna; and in the following

year, in the *London Quarterly*, an elaborate paper on "Malaria."

"He was one of the founders and editors of the *Virginia Literary Museum and Journal of Belles-Lettres, Arts, and Sciences*, a weekly periodical issued at Charlottesville in the interest of the University. He furnished many of the leading and more elaborate articles, the material thus supplied amounting to several hundred pages. Most of the articles were of a non-professional character, and displayed unusual learning and research—as, Fashions in Dress in England at the Commencement of the Seventeenth Century; Onomatopœia; Modern Improved System of Road-making; Certain Ceremonies connected with the Dead; Anthropology; Blondel and Richard Lion-Heart; English Provincialisms; Penitentiary Discipline; Universities; Legends of the English Lakes; Superstition; Americanisms; Early German Poetry; Etymological History; Sanscrit Language; Ancient and Modern Gymnasia; Cradle of Mankind; English Orthoepy; Canals of the Ancients; and Jeffersoniana. Quite a number of these papers were of an exhaustive character."

"He translated Baron Larrey's 'Memoir on the Moxa,' and Magendie's 'Formulary of New Remedies,' edited Hooper's 'Surgical Vade-Mecum,' and contributed largely to various periodicals, medical, literary, and scientific. During the early part of his residence in Philadelphia other works followed in rapid succession. In 1837 appeared the 'Medical Student,' or 'Aids to the Study of Medicine,' of which a new edition, much enlarged, was issued in 1844. His 'New Remedies' was published in 1839, originally

in the American Medical Library, and subsequently in a separate form. It ran through seven editions, the last having left the press in 1856 as an octavo of 750 closely-printed pages. The 'Practice of Medicine' was issued in 1842, in two volumes. It passed through three editions, the last of which, six years after, attained the size of nearly 1500 pages. The next work was a 'Dictionary for the Blind,' in raised type, on the basis of Worcester's English Dictionary, in three huge folio volumes, the joint-production of himself and Mr W. Chapin, Principal of the Blind Asylum of Philadelphia. In 1837 he established the *American Medical Library and Intelligencer*, a monthly periodical devoted to the republication of 'foreign medical and surgical works, and the dissemination of medical news.' It was discontinued in 1842. The portion contributed by him as editor and collator comprised five volumes. In addition to all this vast labour, he edited, with notes and valuable additions, Roget's 'Physiology,' Traill's 'Lectures on Medical Jurisprudence,' and Forbes's 'Cyclopedia of Practical Medicine,' the latter in four large octavo volumes, thoroughly revised and brought down to the existing state of the science. He published numerous addresses, introductory and valedictory, delivered before his classes. Appeals to the people of Pennsylvania on the subject of an asylum for the insane poor; views on cleansing the city of Philadelphia in cholera times; letters on the blind in Europe, and biographical notices of Peter S. Duponceau, Professor Tucker, Judge Kane, and Rev. Dr Bethune, besides numerous other papers which it is needless to mention."

His pen seems to have been engaged upon a great variety of subjects, professional, scientific, and miscellaneous; indeed it would be no easy task to obtain a complete catalogue of his literary labours from first to last. He wrote with immense rapidity, and is said to have been able to dash off from ten to fifteen pages of printed matter in a morning. His biographer credits him with possessing singular facility of diction and power of utterance, a style clear and classical, and a perfect arrangement of his subject-matter, and the use of language adapted to the comprehension of the dullest intellect. Admitting that he was a compiler of other men's thoughts, he showed originality in his work, and rendered very essential service to the cause of "Young Physic" in America. None of his writings were of a catchpenny kind, but rather the result of a careful digest of all the facts and phenomena presented to his mind, along with a thorough sifting of the evidence adduced by others in the support of their special views or hypotheses. "The author of any work exhaustive of the subject of which it treats, must to a great extent, from the very nature of the case, be a compiler; that is, he must avail himself of what is known, and he must so elaborate his material as to exhibit it in the most advantageous light."

In reference to the opinions expressed above, I may be permitted to cite an instance in support that was derived from my student's experience in Edinburgh. During the session 1837–8, my teacher and attached friend Professor John Reid, then deeply engaged in the history of the biological sciences, brought Dr Dunglison's "Treatise on Physiology"

under my notice, remarking that it was the most luminous work on the subject in the English language. The book was then hardly known on this side of the Atlantic. Yet it shone over our best compilations, not only in methodical arrangement, but in containing a more ample *résumé* of all that had been written on the subject by European authors, especially the German, French, and Italian; added to which, the author showed a clear and sagacious discrimination of the merits or demerits of the theoretical opinions advanced by the representatives of the different schools of medicine. Haller and the worthy pioneers of modern physiology met with due attention in the historical review that Dunglison so ably furnished of the growing science.

The "Human Physiology" of Dr Dunglison passed through eight editions, the last being published in 1856. If he had done no more for the literature of medicine than issuing this masterly work, he would have deserved well of his adopted country, and been held in high esteem by all ardent cultivators of physiological science. His "Medical Dictionary" was no less significant in developing the medical aims of others as well as his countrymen; it passed through twenty editions, and its sale amounted to fifty thousand copies. His "Elements of Hygiene," published as early as 1835, was very much an introductory work to a subject that has been growing in interest from that day to this; and it says much for Dunglison's originality of thought and far-seeing character, that he should have been among the earliest pioneers of sanitary reform. His "Practice of Medicine" passed through three editions; his

"Materia Medica" through six editions, and his "New Remedies" through seven editions; so that his works were distributed throughout the length and breadth of the United States. It is computed that the issue of all his works during his lifetime amounted to 150,000 volumes at least; so that it might well be said that no medical author, either in ancient or modern times, had so many readers.

He was very popular as a teacher, and his lectures constituted a great fact in the literary circles of Philadelphia. "Such were his fluency," writes Dr Gross, "and his wonderful command of language, that it was often said of him that he lectured as if he had been wound up, although no one ever accused him of being a mere machine. His great animation, his vivacity, his *bonhommie*, his captivating manner, discountenanced such a conclusion, and impressed the hearer with the conviction that he sat in the presence of an extraordinary man, decidedly the most able and popular teacher of physiology of his day in America." Yet he never lectured without a certain amount of preparation, that showed a conscientious regard for his public duties, and a desire to benefit his pupils to the utmost of his power. The disgusting experiments on living animals which he had witnessed in Paris in the hands of Magendie and Orfila, led to his being entirely opposed to vivisections; and his sensitive nature shrank so much from the infliction of pain, that he never could have practised the surgical department of the healing art. Indeed he was more of a medical philosopher than a physician; at the same time, he was not wanting in powers of diagnosis and an efficient knowledge of

therapeutics: at no period of his history did he approve of the bold and heroic treatment of disease.

"In personal appearance Dr Dunglison was deemed very handsome. He had a fine bluish-grey eye, regular features, a well-formed mouth, and a lofty forehead, denotive of intellect and intelligence. As he advanced in age, his hair, black in early and middle life, became somewhat grey, and the top of the head slightly bald. He was about the medium height, with a well-proportioned frame and limbs, a dignified mein, graceful manners, and genial disposition. His features have been perpetuated in several portraits. . . . In his habits he was eminently orderly and systematic. He knew how to take care of the minutes, and how to occupy his time to the best advantage. All his engagements were so happily arranged that he had time for everything. No hours were ever 'stolen from his meat and sleep,' seldom any from his ordinary enjoyments, pleasures, or amusements. Whatever he had to do he did at once without delay. This promptness was one of the great secrets of his success in life's great struggle."

"In private life Dr Dunglison was a delightful companion, a fond and loving husband, a devoted father, a faithful citizen, true to the best interest of his adopted country, with a warm sympathy for the oppressed of all nations. He adorned the domestic circle, and imparted a healthful charm to all who came within his influence. Born to grace society, he was the idol of his home, and the cherished object of attention wherever business or pleasure called him.

His conversational powers were of a very high order; he possessed great general information, and there was no subject, professional or non-professional, upon which he could not talk intelligently, if not exhaustively. He had a remarkable fund of anecdotes, and often interspersed his remarks with an apt quotation from the classics, agreeing with Dr Johnson that it was a good thing, inasmuch as there is a community of mind in it, and that it is the parole of literary men all over the world. Although an Englishman by birth, he loved his adopted country with all the ardour of a genuine patriot, and rejoiced in every measure designed to advance its welfare and prosperity."

Dr Dunglison took no part in politics. His religious views breathed a broad Catholic spirit, befitting one who had made the study of science his daily habit. In his friendships he was cautious, but sincere and faithful. He loved his books and his pen better than indiscriminately-chosen society; and in pursuing this sagacious course, he acted well for his own comfort and the professional interests of which he was so noble an advocate. He was fond of music, and had a highly-appreciative ear; in his younger days he was a tolerable performer on the flute and piano. His evenings were either spent with his family, or at some place of amusement, as the opera, theatre, or concert. The true man, however, was best seen in his library, where everything was in order, and made subservient to the convenience of study; or in the lecture-room, where his medical lore found eloquent utterance and the most attentive of audiences. "His library, numbering upwards of

4000 volumes, comprised all the more important medical and scientific works in the principal languages of Europe, and was particularly rich in monographs, dictionaries—medical and non-medical—and in treatises on physiology and the cognate branches of science." This rare collection of books is now in the possession of his son.

Dr and Mrs Dunglison had five sons and two daughters born to them. Two of his sons follow the medical profession. Dr Richard J. Dunglison is said to be engaged upon a biographical memoir of his father, for which there are ample materials both in his diary and works. Mrs Dunglison, who had been a true and affectionate helpmate to her husband, died of cardiac disease in March 1853.

> "When silent time wi' lightly foot
> Had trod on thirty years,"

Dr Dunglison was able to carry out a long-cherished wish to visit England, to look at his old home, and above all other considerations, to converse with his dearly-loved mother. It was in April 1854, that he again breathed the air of Skiddaw, and daily met with friends of his youth who "grat to see the lad return" whose clever abilities had won for him such high position in the United States. His mother was still a fine-looking old lady, dressed in the old style, wearing a turban, and altogether a striking person; unfortunately, her memory had so failed her, that she could not recognise him. This, it need not be said, was a great disappointment to Dr Dunglison, but he showed much equanimity, and delighted to talk with her by the hour of bygone days, when she would generally conclude by saying to him, "So you

have seen Robley; he was the best boy that ever was," and so forth, thus showing her loving reminiscences of her favourite son, and her intense satisfaction with his honourable career in America. It is painful to reflect that she who in happier health would have rejoiced to give her son the most affectionate welcome to his home, was no longer sensible to his presence. Her mind had become a blank as regards his personal appearance, yet she still retained the old feelings of maternal love, and these gushed forth on mentioning his name,—a curious psychological condition attendant on the decaying powers of the brain.

Dr Dunglison bid adieu to his native mountains in the autumn, and was fortunate in escaping from his own plan of sailing to America in the *Arctic*, which suffered sad shipwreck. He was heartily welcomed on his return to Philadelphia. Had his visit to Keswick been known beyond his immediate circle, I am disposed to believe that my professional brethren in Cumberland would have seized the opportunity of offering their congratulations to him in some public way, such as would have been deemed acceptable to the wishes of the great Medical Cyclopædist of the nineteenth century.

The great reputation enjoyed by Dr Dunglison is manifested by the many honours conferred on him in his adopted country. The degree of LL.D. was bestowed upon him by two colleges. He was Vice-President of the American Philosophical Society, and also Vice-President of numerous other institutions, and for long held the office of Dean of Faculty of the Jefferson Medical College.

Dr Dunglison suffered greatly from attacks of gout, and with advancing age came additional infirmities; yet he struggled manfully against the pains and dyspnœa of heart disease, and would complete his course of lectures in the winter of 1867–8. His last lecture was on Death, which it was certain must soon overtake himself; and this he seems to have known. One who heard him states—"His voice was throughout solemn, yet most clear and distinct; and he controlled his feelings in a wonderful degree, while many of his young auditors, conscious that they were hearing him for the last time, sat mute and melancholy." After months of suffering he passed away on the 1st April 1869. An autopsy revealed a great amount of disease, particularly of the heart and great vessels. His brain was sound, and weighed fifty-five ounces, being only two ounces more than the ordinary average of men, and eight ounces less than Dr Abercrombie's, and eleven ounces less than Baron Cuvier's. The reader should be guarded against the idea of great cerebral bulk being a proof of great mental power. More depends on the number, size, and depth of the convolutions of the brain, than upon its absolute weight and bulk. Every observer must be familiar with big-headed persons of obtuse ideas, if not verily stupid, and of comparatively small heads containing much wit and sagacity; or in other words, a large brain may be watery and sluggish, a small one compact and active in its manifestations. The brain of my much-lamented friend Sir J. Y. Simpson, whose discoveries and accomplishments were known over every part of the civilised globe, weighed less than Dr Abercrombie's; but then the convolutions

were marvellously developed, and rich in the structure that is associated with the manifestation of the highest intelligence. Dunglison's brain, according to Dr Gross, "was composed of the noblest material, arranged, like the columns of a Corinthian dome, in the most admirable proportions. The harmony and symmetry of his mind were perfect, a circumstance which could not have happened if the cerebral organs had not been cast in the finest mould."

Dr Dunglison was interred by the side of one whom he long and tenderly loved at Laurel Hill Cemetery, Philadelphia, where, it is said, a suitable monument is to be erected.

MUSGRAVE LEWTHWAITE WATSON,

SCULPTOR.

As the bud expands under the influence of solar rays, so does Art-power spring forth in youth when inspired by the great psychological gift—Genius.

WITH the exception of the Lake District, and Eden's fairy bowers at Corby, the Vale of the Cauda, in Cumberland, is hardly to be surpassed in pastoral beauty and attractiveness; more particularly the Sebergham portion of it, which has been not inaptly compared to the picturesque Avoca in Ireland. At the lowest point of the Vale of Sebergham, where it becomes continuous with that of "The Rose," is a ford of the Cauda; and on the left bank of the river an old dilapidated farmstead, called "The Bogg." Here a yeoman family of the name of Watson settled a long time ago; and from their loins Musgrave Lewthwaite Watson, the sculptor, sprang. His father, Thomas Watson, finding bucolic life rather slow and unremunerative, and far from consonant with a life of energy, emigrated to the West Indies, where he made money and acquired

business habits. On returning to Cumberland, he married, on April 6, 1795, Mary, the daughter of Musgrave Lewthwaite, an ironmonger in Carlisle. Thomas and Mary Watson settled down in Hawksdale, on a farm called Low House, now known as Hawksdale Hall, situated two miles lower down the Cauda than "The Bogg," and about six miles S.S.W. of Carlisle. They had three sons and three daughters born to them; their second son came into the world on January 24, 1804, and was named, after his grandfather, Musgrave Lewthwaite. His history constitutes the subject of the following memoir.*

Musgrave Lewthwaite Watson was sent to Raughton-Head School, in the immediate neighbourhood, then under the direction of the Rev. Mr Monkhouse, a man of scholarly acquirements and worth. Being a lad of good parts, and well educated in classics and mathematics, Watson's parents decided on making him an attorney. To this decision young Watson not only showed no favour, but unhesitatingly proclaimed his wish to be a sculptor. Considering his constant devotion to drawing, and his selecting his subjects from nature, the guardians of the lad might have seen that his *forte* was Art; but their family instincts, not exempt from a fair amount of pride, aimed at a professional position for their clever son;

* Before the issue of this series of "Cumberland Worthies" had been determined upon, I had published "The Life and Works of Musgrave Lewthwaite Watson," in quarto form, with numerous illustrations (Routledge & Sons, 1866), and to that volume I beg to refer the reader for a full history of the sculptor. As it was essential to give Watson a place among his county worthies, the present brief memoir is introduced here.

and accordingly, in the year 1821, he was articled to the Messrs Mounsey, solicitors in Carlisle.

Though professedly studying Coke upon Lyttleton, and discharging the routine duties of an articled clerk, his pencil was always in hand when opportunity offered, and his office-desk afforded a convenient hiding-place for his sketches. In the evenings he resorted to wood-cutting and engraving, operating at first on the polished surface of copper pennies or twopenny-pieces. One of his first engravings was to illustrate a poem of Robert Anderson's, a local bard of some celebrity. He showed himself a restless being, whose idol was Art, and whose worship of the goddess was as constant as the hour by Shrewsbury clock; yet he looked upon all his artistic experience as merely preparatory to that of sculpture. His Sundays and holidays at home were devoted to modelling in an upper-room, when his friends supposed he was out in the fields; but the capsizing of a pail of water led to the discovery of his work above-stairs, and much severe reproof on the part of his family.

During Watson's residence in Carlisle Mr David Dunbar was practising as a sculptor, and he established a modelling class for amateurs, which Watson joined. Every one was surprised at the small frame and large intelligence of "the lad Watson," who soon vied with the best hands in the school, and eventually trod closely on the heels of the master himself. Though sculptorial in tendency, nothing came amiss to Watson that fell under the designation of Art; wood, copper, silver, or stone could all be made to yield, under his burin or chisel, forms grave or gay,

natural or grotesque. His pencil outlines, his water-coloured drawings and oil paintings, showed equal ability, touch, and excellence.

Whilst in his teens he manifested the most marked form of somnambulism. For instance, after an awful dream in his Carlisle lodgings, he rushed from his bedroom, knocked down his landlady on the stairs, undid the bolts and bars of the doors with alacrity, and sought the open street, walking with great rapidity towards Eden Bridge, where he awoke at dead of night in the pretty predicament of having no clothing but a night-shirt! More than once his somnambulism was directed to the care of his father's cattle in the fields.

Watson, having no regard for his law studies, availed himself of his father's death, in December 1823, to seek release from office thraldom, and this was granted him in January 1824. His whole attention was now devoted to Art, not without incurring the great displeasure of his friends, who could not see in his apparent waywardness the strong bent of a will ripening into wisdom. He lost no time in his arrangements for visiting London, and, bidding adieu to his lady-love, the daughter of an innkeeper in the Carlisle suburbs, mounted the box of the south mail at a very early hour next morning. Sitting on the coach-top, and strongly muffled up against the rain, was a lady who, at the end of the third stage, revealed herself as the fair Helen of his affections, who had stealthily left her home to share her fortunes with the young artist, and would not be said nay. There was but one course open to the young couple, namely, to go together for better and worse.

What, it may be asked, were the circumstances that favoured Watson's strong bias for Art—altogether an irresistible passion. He was brought up in a solitary farmhouse, his birthplace, shaded by ancient yews and lofty elms, with green meadows spread around it. Of healthy, animated nature he had enough and to spare. His daily walks to school afforded him one of the most charming bits of landscape in hill and dale, rich sward graced by ancient forest trees, and between its banks of copse, or the margins of the broader vale, the pebbly stream of Cauda—

> "Now shining, now foaming,
> Now hiding, now roaming,"—

in its onward descent to the sea,—a well-adorned park where the mediæval ramparts and ivied towers and chapel of Rose Castle stood as lordly claimants of the soil; then wooded upland rising above upland, till the highest became merged in the Skiddaw range of mountains, and the line of earth was lost in the grey fleeting clouds, or stood in bold relief against the blue expanse.

The poetical imagination of Watson could not fail to recognise the surpassing beauties of a vale in which his early years were cradled and nurtured; but how far this natural grandeur served to quicken his feeling, or to fix his belief in Art, is a question less easily solved, and only soluble on a further consideration of his history viewed in relation to other followers of sculptorial art. Thorwaldsen, the Dane, was reared in a dirty hovel by the docks of Copenhagen; Canova was cradled in "the city of the sea," and with the good fortune of looking upon the grand St Mark's

and the palace of the Doges; and Flaxman first saw the light of day in the back-shop of a dingy London street, and a sadly delicate Cockney he was. It cannot be shown that Watson's initiative in Art sprang from the love of external nature and bovine herds, or that Thorwaldsen's was influenced by the Copenhagen "Wapping," its fish-fags and howling dogs, or Canova's by "listening to the song and oar of Adria's gondolier," or Flaxman's by the whirl and excitement of modern Babylon; nor was the Art-culture of these men in their riper years affected in any noticeable way by their juvenile relations or companionship.

True excellence in Art is a rare quality, the possession of which is vainly sought after by the crowds of aspirants who enter the arena of competition in the belief that Art is an educable feeling, to be purchased by time, money, and schooling. No doubt the faculties of man, like his muscles, may be promoted by exercise and good direction; and industry, persevered in for years, has often measured its lines by the side of a brighter inspiration; but Art-culture is not a thing to be planted, nurtured, and ripened at will. Art-feeling is met with under the most variable circumstances, amongst hewers of wood and drawers of water, whose brows bear the dewy drops of toil, in the back-shop or on the open sea, within the circle of courts and in the study of philosophers. And it may be safely said that neither schooling nor training, neither probation nor practice, can make an artist of high order "with brains, sir!" The true artist, like the true poet, is born, not made; and the artistic germ can no more remain latent in

man than the natural growth of the organism stand still in health, but continually seeks expression in lines, forms, and groups.

Watson took the earliest opportunity of calling upon the celebrated Flaxman, by whom he was well received, and well counselled as to the future. For a time he was with a Mr Sievier, but to no great purpose, beyond introducing him to Mr Woodington, whose friendship he valued through life. The subject of Watson's probationary work for admission to the Royal Academy was a "Shepherdess" that received the commendation of Flaxman. To the "Carlisle Exhibition of the Fine Arts," opened in September 1824, he contributed no less than five of his works, and gratified his friends that he was making satisfactory progress in sculpture. During the later autumn he engraved a good deal on copper, and copied some famous Dutch etchings, that were considered of value by competent judges. He now prepared himself by studying the Italian and French languages for going to Rome, and on the following year started for Paris, vowing that he would not speak a word of English till his return.

From Paris he went to Milan, and then on to the capital of Tuscany. On reaching Florence a new light dawned upon Watson. Florence, truly "*la bella*" in Art treasures, in paintings, sculpture, cameos, medals, and bronzes, and not less in showing the best of Italian mediævalism, is a focus of attraction to the learned and curious of all nations. There, in her grand city-halls, where liberty had its struggles, and freedom not seldom its defeats as well as its victories, are the marble busts and portraits of the men of a

renowned Italy, suggestive alike of hero-worship and reverence; there, in churches, repose the dust of a glorious dead memorialised as befits the sons of immortality by a grateful people. Standing in the open square near the grand old palace, architecturally unrivalled, with its lofty overhanging tower as if "built in the air," he had before him the Loggia de' Lanzi, with its "Perseus," its "Dying Ajax," and its "Sabine Group;" and close by, the gallery of the Uffizi, with its niched aërial court, containing statues and portrait-memorials of world-famed Italians; and, not far distant from these edifices, the Grand Duomo, Campanile, and Baptistery, the gates of which conferred immortality on the names of Andrea Pisano, Giotto, and Ghiberto. He saw with pleasure the honours and homage paid by the Florentines to their representative men, noting especially the busts of those who had given immortality to Italian Art, and felt the contrast—too marked—of this high appreciation with England's neglect of her aristocracy of intellect. In London, statues of imbecile, dethroned, and riotous kings stride the thoroughfares, and foreigners look in vain for the sculptured portraits of England's greatest sons; *e.g.*, Bacon, Newton, Shakespeare, Cromwell, and Raleigh.

Watson next went to Rome, where he remained two years, earnestly occupied in studying languages along with his more absorbing art. Pleased with the Art Galleries of the Vatican and Capitol, he felt more strongly than ever the imitative and formal character of English sculpture, and sought to shake off the feebleness of his own nationality in Art by an earnest study of the Greek and other standard models. In

proof of his earnestness, he eschewed Englishmen of all grades and societies, and was altogether unknown to his compatriots, artistic and *dilettanti*, in Rome, an immense advantage to his intellectual culture, his linguistic acquirements, and Art education.

Having parted from his Cumbrian relatives somewhat unpleasantly, they heard nothing of him for months, and at length began to entertain fears of his death. Mr Dunbar, the sculptor, journeying to Italy on business, was earnestly requested to seek for him in Rome; but so thoroughly had Watson kept aloof from his own countrymen, and linked himself with the German students, that the search proved nearly fruitless. When discovered as the "shy German," he was just recruiting from a fever that had reduced him to so low an ebb that his landlady and the neighbours deemed him beyond all hope, and had actually began to arrange the usual ceremonies for the dead. The hubbub arising from a desire for his soul's solace roused Watson in time to save his emaciated body from premature interment.

In one of his letters from Rome, addressed to his friend Dr Robert Abraham, in 1827, he writes—"I laughed at your letter advising me about religion, politics, and women. The first I know nothing of, and care as little; the second never enters my head; and the skirts of the ladies I never touch. I do not wish to partake of the follies, foibles, and vices of the people with whom I come in contact, but to benefit all in my power professionally."

To eke out his pecuniary resources in Rome, Watson practised different forms of Art to suit the varied tastes of connoisseurs and purchasers—etching,

carving, designing for cameos, &c., with a facility of execution that few of his rivals could surpass. And it may be added that he lost none of the advantages which Rome offers so abundantly to the student of sculpture. He spent some time in Naples, apparently enlivened with the bay, its isles, and the grand scenery along its shores—the *diversorium* of Roman vices in the time of Seneca, and to-day a paradise for painters possessed of true feeling and powers of colouring—and pleased to recall the historical associations of a district linked with the life and writings of Virgil, the rural retirement of Cicero, the holiday-making of Horace, and the court and grandeur of Augustus. With the view of studying the art and ruins of Pompeii he also indulged in a little proletarian vagabondage, which enabled him to make some admirable sketches of brigand groups, reminding one of those *chevaliers d'industrie* who frequent the Salerno and Pæstum roads, or hang by the outskirts of Itri and Fondi, types of Marco Sciarro and Fra Diavolo.

He returned to London, then visited Carlisle, where he executed busts of Dr John Heysham and Major Hodgson, which were sent, with several sketches in water and oils, to the Carlisle Exhibition of 1828. He carved a small *alto-relievo* figure as a memorial to his schoolmaster in Raughton-Head Chapel, and in honour of his father placed in Sebergham Church a tablet showing the profiles of three female heads—*Tria Fata*—which called forth much speculative comment.

Finding it advisable to follow his art in the metropolis, he took a studio in Rathbone Place, but failing to obtain commissions, sought employment

with Chantrey, and worked upon the Digby monument. Quarrelling with Chantrey on pecuniary grounds, he modelled on his own account "The Jolly Friars." This work so pleased Behnes, the sculptor, that he asked Watson's co-operation in the statue of Dr Babington for St Paul's Cathedral. This statue owes almost all its character to Watson's skill.

"THE JOLLY FRIARS"

are in the Hogarthian style of Art, bold, uncompromising, and sarcastic. The group consists of two figures, broad-built members of the clerical-jubilant, who in their cups seem

"O'er a' the ills o' life victorious."

Both monks display low foreheads, jolly noses, and deep double chins, with short necks—apoplectic, very. No words can convey the character of the jovial friars, teeming with individualism and life, sparkling with the Attic salt of Art, and constituting a group of very choice Italian. The original work is in my possession at Rose Hill, Carlisle.

Watson was one of the competitors for the Lord Nelson monument. The competition was a sham throughout, and the result was the erection of a Corinthian column, with the hero of Britain's glory perched on high, as if the mast-head had been the summit of Nelson's ambition.

THE POETS.

For a time he made the Homeric poesy his study, but finding no encouragement to pure Classic Art, he sought subjects for his pencil in the "Canterbury

Tales" and "Faerie Queene." He modelled statuettes of Chaucer, Spenser, Shakespeare, and Ben Jonson, from a wish to revive the great worthies in English poesy, by making their portraits popular and accessible to all. He could not satisfy himself with Shakespeare, so broke it to pieces; the others remain, and have claimed much admiration for their expressive character and appropriateness. He had given large attention to the costume prevailing in different periods of English history, as if preparing for the issue of a series of national portraits. About this time he received a commission for medallions of Dante and Raphael, and Dante and Beatrice, which proved his feeling for Italian Art. In 1840–41, he took to electrotyping, and became enthusiastic in its application to his own art. Some of his efforts claimed the highest admiration of Bailey, the sculptor; nor were they less esteemed by Sir Charles Eastlake, to whom Watson bequeathed all his electrotyping works.

THE OUTCASTS, OR MOTHER AND CHILDREN IN A STORM,

consist of a mother and three children, sketched in clay. This marvellous piece of modelling, on the diminutive scale, could hardly be surpassed. Drawn from the streets of London, the group shows a family half-naked and all forlorn, apparently pinched with hunger, and struggling against the wind and rain. There is no polish or finish in the work, yet of itself is as finished a sketch of human nature "out in the cold" as English art can furnish. The "outcasts" are in my possession, and no copy was ever made of the

work. When my much-lamented friend John Henry Foley, the greatest sculptor of our times, visited me a few years ago, he remarked that such a group done in life-size and in marble, as it could have been executed by Watson, would have ranked among the best specimens of English Art.

THE SARPEDON

is a work wherein Watson illustrates the advice given Jove by the goddess with the radiant eyes—

> "Give the bold chief a glorious fate in fight,
> And, when th' ascending soul has winged her flight,
> Let Death and Sleep convey, by thy command,
> The breathless body to his native land."

Watson's group is classical in the highest degree, and consists of three figures. A Destiny—aptly indicative of the stern, the strong, and the swift—bears the body of the hero, and, though unaided by wings, seems to penetrate space with a flowing motion. The left arm of the Destiny is extended forward, as the upraised brows and eyes of more than mortal ken are directed to the goal beyond. His hand grasps the emblematic asp, and twined in his hair is the same significant token. Sleep, a more fragile form, compassionate and placid, sustains the head, and with gentle tenderness enfolds the form of the departed. Sarpedon occupies the centre, with head and shoulders slightly raised, but with arm dependent, and in the attitude natural to death. The eyes are closed, but in his countenance are the noble repose and grandeur of the heroic spirit. The muscular contour of the warrior is associated with all the perfection of human beauty. Throughout the group the anatomy is true

to nature, and, as in the dependent and semi-curved hand, bearing a physiological suggestiveness rarely met with in Art. Sarpedon enshrines the spiritual idea of death—

> "Before decay's effacing fingers
> Have swept the lines where beauty lingers,
> And marked the mild angelic air,
> The rapture of repose that's there."

If Watson had done nothing more than show how death could be typified by a simple tranquillity rather than by the skeleton, and other hideous emblems—the remnants of a barbaric age—he would have been entitled to high praise for his appropriate treatment of the subject.

The English taste stands in need of culture by academies when the provincial artist can content his patrons with "skulls and cross-bones;" or when, in less heinous outlines, but not less questionable regard for historical correctness, he adopts "the scythe and hour-glass."

> "On some frail memorial, ...
> With uncouth rhymes and shapeless sculpture decked,"

the attributes of old *Chronos*, or Time, a different personage altogether from "Old Mortality"—Death. The Egyptians—Pagan, Trinitarian, or Polytheistic as they might be—had more dignified notions of death six thousand years ago than some of the eighteenth century Christianised British sculptors, as is well seen on comparing the delineation of the "Goddess of the Western Shores," in the tombs of the kings at Thebes, with the monument to Miss Nightingale by Roubilliac, in Westminster Abbey.

It is much to be regretted that Watson did not carve the Sarpedon in marble as one of the most classical and noble of his productions, so that—

> "The kindled marble's bust may wear
> More poesy upon its speaking brow,
> Than aught less than the Homeric page may bear."

He had an engraving of the work executed by Mr A. R. Freebairn's anaglyptic process—one peculiarly adapted to the Sarpedon; but he would neither publish nor sell copies of the engraving.

THE FRIEZE IN THREADNEEDLE STREET, LONDON,

occupying the space between the windows and entablature in the façade of the London or Consolidated Bank, consists of a series of bas-reliefs, extending 73 feet, illustrative of the advantages and blissful influences of Commerce. In the interior of the building is another work of Watson's. As a specimen of architectonic sculpture, the frieze attracted the attention of the world of Art in London during the summer of 1842, and was highly praised by the *Athenæum*, *Fraser's Magazine*, and other trustworthy journals.

THE ELDON AND STOWELL MONUMENT

offered a curious chapter in Watson's own history, as well as in the history of Art. There is no space, however, to dwell upon it in this brief outline of the sculptor's labours. The monument was meant to commemorate the great chancellor and his brother, Lord William Stowell, the famous judge, and consists of two portrait-statues placed side by side. These twin statues, as Watson called them, occupy the

Library of University College, Oxford, and cost from first to last about £14,000.

The Eldon and Stowell group unquestionably ranks with the first works of Art in Great Britain. The severe attitude and solemn air of the law lords is indicative of justice, and the utterance of wise saws and modern instances is fully exhibited in this work of high excellence. The group, along with the portrait-statue of Flaxman by Watson, were exhibited in the Exhibition of 1851, and gained a prize medal. According to Mr F. T. Palgrave, the Eldon and Stowell group forms one of the six "truly fine monumental works which have been produced within the century." Rogers the poet, and other competent judges, offered their willing testimony to Watson's great success in depicting the very pillars of law and justice.

THE CAMERON MONUMENT

is an *alto relievo* composition (93 by 37 inches), representing wounded and dying men on a battlefield, affectionately tended by the doctor, or their wives and relatives. The hero of the scene is Dr Archibald Cameron, who joined his fortunes with "Bonnie Prince Charlie," and acted as surgeon in the last struggle of the Stuarts on the field of Culloden. This admirable work, so well suited to Watson's genius, was done in Caen stone, and placed in the Savoy Chapel, London, in 1847; it unfortunately fell among the ruins of the fire that destroyed the chapel in 1864.

He competed for the London Royal Exchange pediment that fell designedly to the hands of Messrs Joseph and Westmacott. Watson must have seen the supe-

riority of his drawings to those of the successful candidates, when he sent them to the Royal Academy, bearing the inscription of being rejected by the Gresham Committee.

Although he lost the opportunity of doing a great work for the metropolis, he had the satisfaction of eliciting a large share of the best public opinion in favour of his designs.

THE LONSDALE AND AGLIONBY STATUES.

Standing in the open street between the massive round towers or Courts of Assize in Carlisle is an excellent statue of the Earl of Lonsdale (1802–44), and within the Criminal Court-House is an equally worthy statue of Major Aglionby commissioned to Watson by the gentry of Cumberland. Both portraits are appropriately costumed, and characteristic of Watson's manly and vigorous style. Every Cumbrian was pleased to see the skilful achievement of their countyman; and now that one of the late Mr Foley's surpassingly fine works, the portrait-statue of the late (fifth) Earl of Carlisle, has been erected on the Moat at Brampton, Cumberland may well be proud of possessing such noble specimens of the best British Art. I wish my countymen could be induced to pay similar monumental honours to Dr John Dalton, John Christian Curwen, Sir James Graham, and other worthies, either in the form of portrait-statues or busts upon which future generations of Cumbrians might gaze with feelings of admiration and reverential regard.

Watson was on pleasant terms with Rogers the poet, and sought to illustrate his poem on Human Life in a

series of cartoon drawings, based on selected quotations from it. These drawings were published after Watson's death in large folio, and met with a ready market.

THE FLAXMAN STATUE

was a labour of love to Watson, as his admiration for the great sculptor was unbounded. This portrait-statue is placed on the staircase leading to the "Flaxman Gallery" of University College, London. Perhaps no work of Watson's claimed so much public attention, owing to Prince Albert and some of the leading patrons of Art having shown special interest in the work. Yet only £400 was subscribed; and so inadequately were the services of Watson remunerated, that his contribution literally doubled all the subscriptions of his patrons.

I should gladly have offered some remarks on Watson's Man's First Sacrifice, his Lucifer and Cain, Allan Cunningham's Memorial, and other works illustrated in my quarto volume; but sufficient has been said to show the character of his works: moreover no limited words can produce any description like the true nature of sculptorial art.

HIS PORTRAITURE.

Watson presented the spare figure of a man considerably below the medium height, a conspicuous head, thinly covered with sandy-coloured hair, a pale face, eyes penetrating, but far from prominent, a pinched aquiline nose, and well-proportioned mouth and chin. As age advanced there was a worn-out

look about him—the marked aspect of a man suffering from bodily disease; the hair had fallen off considerably from the head, and a shining baldness made that head still more striking. He had long sinewy arms, with slight tapering fingers—the artistic form, according to D'Arpentigny, and recognisable by the dullest observers. His temperament was highly nervous. His profile recalled a portrait of Fra Bartolommeo, and by many of his contemporaries Watson was considered to have a Flaxman's head, as he had a Flaxman's gifts, and probably these gifts in a higher degree than any man of his own times.

Naturally kind-hearted, he liked to be helping others, and this he did with no sparing hand. To his assistants and work-folk he rendered many good services. Wanting in equanimity, to-day he was the victim of doubts, depression, and despondency, to-morrow he rose with hopes and lofty aspirations; and so the wheel went round, its movements in no small degree influenced by dyspepsia and impaired health. When pleasantly encouraged in his work, he was at home with everybody; but if he had to encounter currents of stupidity and ignorance, then woe betide the offending mortals who came between the wind and his nobility. He could be cynical, and at times aggressive, with a "troublesome friend," and no doubt his tongue and pen got him into difficulties that a wiser policy would have avoided.

In conversing with those who knew Watson intimately, the writer has frequently elicited the remark, "Ah, sir! he was a lost man—what he might have been if encouraged." One who lived in the closest relation with Watson said to the writer, "No one

like Watson; a fair start and good health, and he would have left a great name in the history of Art." Mr Foley, sculptor, whose death I shall ever lament, thus expressed himself:—"Watson was cut off in his prime, hardly known to the public, but well-known to sculptors as the man of his day—a true genius. He should have been more appreciated as he was capable of anything in his Art. He gave in the best designs for a number of public works, statues, &c., contemplated in his time, and never got a commission he so well merited. Truly lost." The word lost is sad to quote, but it is the only term applicable to the man, and to his position among his brethren; nor was he less lost to the community whose patronage, if better bestowed, would have secured in him one of the ablest representatives of English sculpture. Watson clung to independence and isolation rather than conform with the usual practice of young sculptors; hence he was, in some degree, lost to the guild of artists.

Watson's sculpture has a character of its own—specially seen in the works which came from his chisel when he was approaching his zenith—stamped with an originality and clear meaning in Art. A harmony of relation pervades all his compositions; hence the pleasure and repose they afford the observer. There is neither prominent feature nor undue detail, but an equanimity in the association of Art with Nature, that gives breadth of feeling to his works. He borrowed but little from the accessories of Art; and meretricious ornament, or anything of the *ad captandum vulgus* character, found no place in his studio. He was faithful to Flaxman,

and antipodal to Roubilliac in this respect. All, or nearly all, was told by Watson that Art could tell by line, or that Nature and æsthetic refinement could suggest; yet nothing was told too strongly or abruptly. His works, when the strictly academical or historical were aimed at, bore the culture of scholarship, and the grace and the dignity of Art. Even in those instances where anatomy was in part requisite, he kept it in abeyance like a true sculptor —hiding the framework of the body and muscular swellings, in which Michael Angelo, and others less worthy, yet wishing to be more imitative, indulged.

Watson possessed a feeling for *generic* Art, along with a successful cultivation of its *individuality:* as he could particularise the smallest details, so could he group numbers of figures with pleasing harmony —well seen in the Cunningham Memorial, and in his compositions of the Cameron Monument and First Sacrifice. There was nothing flimsy and nothing shadowy in his works, but everywhere a force and a meaning—natural, free, and not seldom poetical and classical.

Watson was full of anecdote and fun, and hearty in company if he had confidence in the party; and his conversation was highly intellectual, an d not seldom impressive, as it could also be sarcastic. He was fond of disputation, and not easily overcome in argument, and, when roused by contradiction, could hit his antagonist as hard in words as he could his enemy at a distance by the sting of his pen. Give him a patient listener, and Watson would talk for hours on the philosophy of Art—the glories of its past history, its struggles, its decadence, and reason

not less correctly on the groundwork of its revivalism. In this kind of talk he soared too high for his brethren, many of whom looked upon Art-philosophy as dreamy, and national feeling as worth cultivating only for the sake of its Art-guineas.

In seeking the ideal of high Art, Watson was no copyist of other men's labours—not even of the antique. His freedom of style prevented him from ever becoming a mannerist. Perhaps no man in his day showed less repetition of himself in his works than Watson; and as there was nothing monotonous, so there was nothing artificial in his designs. His art bore the naturalism of life—nothing abrupt, nothing forced or strained for effect. "Full of life, sir, full of life," as the worthy Italian remarked of Watson, and adding in broken English—"Did so fast, and such beautiful things, sir." The free and the graceful pervaded every effort of Watson's, along with a simplicity and purity of feeling. When the subject demanded, as in "The Outcasts," or in the illustration of Roger's poem, he invested his lines with a tender and devotional spirit. In treating the classical and the poetical, he was specially fine, pointed, and grand in Art.

After a long illness, Watson died on the 28th October 1847, and was buried in Highgate Cemetery. A tombstone marks his last resting-place.

No man laboured more earnestly than Watson in search of the true and the beautiful in Art, and, considering his age and opportunities, few attained greater success and distinction. He possessed the endowments of the great pioneers and masters in Art—invention, facility in work, a rare classical

sentiment, with breadth of feeling, and the finest line and delicacy of execution. Had he lived to carry out his projects, or had he had the chance of the Royal Exchange pediment and other works to which his great powers entitled him, he would have lent considerable impetus to English Art; and though this was denied him in part, his Flaxman, Sarpedon, the Eldon group, and Carlisle statues, will continue as examples of his genius, and not less profitable as studies for another generation, along with those of Flaxman and Foley.

Illustrated with Photographs. Price One Guinea.

BY THE SAME AUTHOR,

THE LIFE OF

MUSGRAVE LEWTHWAITE WATSON,

SCULPTOR.

—o—

OPINIONS OF THE PRESS.

"In one respect, and only one, Watson has been lucky—he has had a worthy biographer, whose book is almost the only one relating to the art or its professors in our language worth reading, except the Lectures of Flaxman. Dr Lonsdale's life is very interesting, and is illustrated by photographs of the principal works of his hero."—*The British School of Sculpture, Edited by William B. Scott.*

"We hope that this handsome and well-illustrated book will serve to make the name of one of our best sculptors more familiar than it has hitherto been to his countrymen. Watson has now a chance of being remembered and honoured: he has fared better in his biographer than some of his more celebrated contemporaries in painting. . . . . Dr Lonsdale is entitled to the same praise as Mr Lockhart (the biographer and son-in-law of Sir W. Scott) for speaking out; and this virtue, always refreshing to the unsophisticated mind, is doubly so when exercised upon sculpture in England during the nineteenth century, than which we know no subject which stands more in need of an honest and discriminating historian. . . . . But we have not space for half the examples which Watson's life affords of the fate of a great artist in a country which cannot understand him, and we must content ourselves with heartily commending Dr Lonsdale's book to those of our readers who care to see the tragic spectacle of genius contending with adverse fortune, with wealthy ignorance, pompous conceit, subtle selfishness, and trumpet-blowing imbecility."—*Saturday Review.*

"It is hardly needful to go beyond the Eldon group at Oxford for proof that Musgrave Watson was the ablest and most gifted sculptor during the second quarter of this century. If further proof be desired, the beautifully-illustrated volume before us will, however, supply it in the bas-relief of Sarpedon, &c. &c. There are other things of merit also in Dr Lonsdale's book, which those who care for Art, or for a story of tragic interest, will do well to read. The author tells his tale with much spirit and cleverness, and the illustrations are so numerous and so good, as to make it one of the best gift-books of the season. . . . . The career of the honest, gifted, and trained sculptor, in contrast with that of his rivals, could not be more clearly or impressively set forth."—*The Spectator.*

"In this very handsome volume, Dr Lonsdale, of Carlisle, adds to our Art-literature the life of a Cumbrian sculptor of true genius. As a biographer, Dr Lonsdale is genial, liberal, and thorough. If his narrative is here and there a little encumbered, it is with good thought and good matter always. The whole spirit of the work is entirely unaffected, so perfectly does the writer, as he should, forget himself in his complete attention to the subject. . . . . The work, indeed, appeared among the Christmas books, but its interest is lasting, and we have preferred to keep it by us until the beginning of the Art Season.

"We might have begun to-day with Mr Wornum's 'Life of Holbein,' or Mr Fergusson's 'History of Architecture;' but no, let us set the front of our *causeries* on Art the story of one of our own men of genius, who in our time struggled up the rugged steep with little help, fell upon the road, and is remembered with due honour eighteen years after his death."—*The Examiner.*

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"Every one who takes an interest in British sculpture will thank Dr Lonsdale for this book. . . . . He has done good service to artistic biography. . . . . The story of Watson's life is agreeably written; his art is reviewed in a spirit and in language that evidence a cultivated mind and a knowledge of the subject discussed; while the character and actions of the man are touched upon with a delicacy and tenderness of feeling that do credit to the author's heart."—*Art Journal.*

"A biography of such a man as Watson is well worth having; it was due to his genius no less than his misfortunes. Dr Lonsdale has done us a favour by taking up the subject in a loving manner; it is doubtful if any writer could have done the work better for his friend, unless, indeed, he possessed a larger power of criticising, and a better-rooted knowledge of Art. Of both these advantages, however, he has sufficient to make a commendable book, with the rare merit, among artistic biographies, of being moderate in length."—*Athenæum.*